7610-G78-5981

TM 11-5826-218-12

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR AND ORGANIZATIONAL
MAINTENANCE MANUAL

COMPUTER SET, NAVIGATIONAL AN/ASN-33 AND COUPLER, INDICATOR CU-865/ASN

HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1962

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 115-volt power connections.
Serious injury or death may result from contact with these terminals.

DON'T TAKE CHANCES!

This technical manual contains copyrighted information. The copyrighted material in this technical manual is owned by Collins Radio Company. (C) Collins Radio Company 1957–1958

*TM 11-5826-218-12

TECHNICAL MANUAL
No. 11-5826-218-12

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *19 February 1962*

Operator and Organizational Maintenance Manual

COMPUTER SET, NAVIGATIONAL AN/ASN-33 AND COUPLER, INDICATOR CU-865/ASN

		Paragraph	Page
CHAPTER 1.	INTRODUCTION		
Section I.	General		
	Scope	1	3
	Forms and records	2	3
II.	Description and data		
	Purpose and use	3	3
	Technical characteristics of Computer Set, Navigational AN/ASN-33	4	5
	Technical characteristics of Coupler, Indicator CU-865/ASN	5	6
	Components	6	6
	Common names	7	6
	Description of flight system	8	7
	Description of instrument amplifier	9	7
	Description of steering computer	10	7
	Description of course indicator	11	8
	Description of approach horizon indicator	12	8
	Description of sensor	13	9
	Description of flight system vertical gyro	14	9
	Description of vor coupler	15	10
	Description of mountings	16	10
III.	Equipment functions		
	Flight system equipment functions	17	11
	Instrument amplifier, equipment function	18	12
	Steering computer, equipment function	19	15
	Flight system vertical gyro, equipment function	20	16
	Sensor, equipment function	21	16
	Vor coupler, equipment function	22	16
	Approach horizon indicator, equipment function	23	16
	Course indicator, equipment function	24	17
CHAPTER 2.	OPERATING INSTRUCTIONS		
Section I.	Operator's controls and indicators		
	Approach horizon indicator	25	18
	Course indicator	26	19
II.	Flight system operation		
	Preliminary operations	27	19
	Basic flight system operations	28	20
	Typical flight system indications during flight	29	23

***This manual supersedes so much of TM 11-5826-218-12P, as is applicable to the maintenance allocation chart and basic issue items list.**

		Paragraph	Page
CHAPTER 2.	OPERATING INSTRUCTIONS—Continued		
Section III.	Typical flight procedures		
	Climb-out and dead reckoning navigation	30	24
	Var navigation	31	25
	Typical approach	32	27
	Vor navigation	33	28
	Vor approach	34	28
	Ils holding pattern	35	30
	Ils approach	36	32
	Ils final approach and go-around	37	33
	Ils back course	38	35
	Radar approach	39	35
	Operation under unusual conditions	40	38
	Stopping procedure	41	38
CHAPTER 3.	ORGANIZATIONAL MAINTENANCE		
Section I.	General		
	Scope of organizational maintenance	42	39
	Tools, test equipment, and materials	43	39
II.	Maintenance procedures		
	Preventive maintenance	44	39
	Visual inspection	45	40
	Equipment performance checklist	46	40
	Removal and replacement of flight system components	47	43
CHAPTER 4.	DEMOLITION OF MATERIEL TO PREVENT ENEMY USE		
	Authority for demolition	48	45
	Methods of destruction	49	45
APPENDIX I.	REFERENCES		46
II.	MAINTENANCE ALLOCATION		47
III.	BASIC ISSUE ITEMS LIST		54
GLOSSARY			56

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual describes Computer Set, Navigational AN/ASN–33 and Coupler, Indicator CU–865/ASN (fig. 1) and covers their operation, pilot's preflight checks, and organizational maintenance. Also included are basic flight system equipment functions, three appendixes, and a glossary.

b. The nomenclature Computer Set, Navigational AN/ASN–33, as used in this manual, includes all components shown in figure 1 except Coupler, Indicator CU–865/ASN and Mounting MT–2417/ASN. Coupler, Indicator CU–865/ASN and Mounting MT–2417/ASN (fig. 1) are supplied as part of the flight system and, when installed with Computer Set, Navigational AN/ASN–33, comprise the complete flight system.

2. Forms and Records

a. Unsatisfactory Equipment Report. Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) as prescribed in AR 700–38.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army).

c. Preventive Maintenance Forms. Prepare DA Form 2391–2 (Aircraft Flight Report and Maintenance Record, Aircraft Inspection and Maintenance) in accordance with the instructions on the form.

d. Parts List Forms. Forward DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) directly to the Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS-ML, Fort Monmouth, N.J., to recommend changes in, or to comment on, Basic Issue Items Lists or Repair Parts and Special Tool Lists.

e. Comments on Manual. Forward all other comments on this manual direct to the Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA2d, Fort Monmouth, N.J.

f. Index of Equipment Publications. Refer to DA Pamphlet 310–4 to determine what Changes to or revisions of this publication are current.

Section II. DESCRIPTION AND DATA

3. Purpose and Use
(fig. 1)

a. Purpose. Computer Set, Navigational AN/ASN–33 and Coupler, Indicator CU–865/ASN integrate the functions of the aircraft's very high-frequency omnidirectional radio range (vor) receiver (Receiving Set, Radio AN/ARN–30 or equivalent), magnetic compass system (Slaved Gyroscope Magnetic Compass System Type MA–1 or equivalent), and glide slope receiver (Receiver Group AN/ARA–54 when installed) to provide the pilot with continuously computed and displayed navigational flight data.

b. Use. The integrated system of navigational components is used to compute and display to the pilot (on Indicator, Course ID–883/ASN and Indicator, Attitude-Navigation ID–882/ASN) the following navigational information:

(1) Pitch attitude of the aircraft with respect to a selected pitch reference.
(2) Bank attitude with respect to the horizon.
(3) Matnetic heading of the aircraft.
(4) Position of the aircraft with respect to a selected magnetic heading, vor radial or localizer course, and glide slope.
(5) Steering guidance information (direction of turn necessary to arrive at a preselected course).

A. COMPUTER, NAVIGATIONAL CP-583/ASN, AMPLIFIER ASSEMBLY AM-2853/ASN, AND MOUNTING MT-2416/ASN
B. INDICATOR, COURSE ID-883/ASN
C. INDICATOR, ATTITUDE-NAVIGATION ID-882/ASN
D. GYROSCOPE, RATE CN-709/ASN
E. GYROSCOPE, DISPLACEMENT CN-708/ASN
F. COUPLER, INDICATOR CU-865/ASN AND MOUNTING MT-2417/ASN
TM5826-218-12-8

Figure 1. Components of Computer Set, Navigational AN/ASN–33 and Coupler, Indicator CU–865/ASN with Mounting MT–2417/ASN.

4. Technical Characteristics of Computer Set, Navigational AN/ASN–33

(fig. 1)

a. Computer, Navigational CP–583/ASN.

Voltage requirement	115 volts ac ±11.5, 380 to 420 cps.
Input signals:	
Hdg mode	Selected-heading error, actual magnetic heading of aircraft.
Ils mode	Localizer deviation, course datum, and bank.
Output signals, hdg and ils modes.	Mixed and amplified to steering pointer.

b. Amplifier Assembly AM–2853/ASN.

Voltage requirements	115 volts ac ±11.5, 380 to 420 cps sources (two supplies) (stepped down to 26 volts internally) for compass servosystem and bank and pitch servosystem.
Servo channels:	
Pitch and bank	To Indicator, Attitude-Navigation ID–882/ASN.
Compass repeater	To Indicator, Course ID–883/ASN.
Warning flag circuits:	
Pitch and bank servo	GYRO flag operation.
Compass repeater servo.	COMPASS flag operation.

c. Indicator, Attitude-Navigation ID–882/ASN.

Steering pointer:	
Deflection	30° left and 60° right.
Meter movement	1,000 ohms.
Deflection current	Full-scale left, 0.85 ma. Full-scale right, 2.2 ma.
Pitch bar:	
Deflection	±85°.
Speed of indication	60° per second.
Sensitivity	+20° to −20°: 0.003-inch deflection per degree of pitch; +20° to +70° and −20° to −70°: 0.012-inch per degree of pitch; above +70° and below −70°: 0.006-inch per degree of pitch.
Horizon disk:	
Bank scale divisions	10°, 20°, 30°, and 60° (each side of center).
Speed of indication	360° per second.
Freedom of rotation	360°.
Glide slope pointer:	
Meter movement	1,000 ohms.
Deflection	5 dots up; 5 dots down.
Deflection current	±150 microamperes.
GS flag:	
Actuator	1,000-ohm meter movement.
Actuating current	Starts moving at 160 microamperes. Fully masked at 265 microamperes.
LOC flag:	
Actuator	1,000-ohm meter movement.
Actuating current	Starts moving at 160 microamperes. Fully masked at 265 microamperes.
GYRO flag:	
Actuator	1,000-ohm meter movement.
Actuating current	Starts moving at 0.85 ma. Fully masked at 2.2 ma.
STEERING flag:	
Actuator	1,000-ohm meter movement.
Actuating current	Starts moving at 0.85 ma. Fully masked at 2.2 ma.

d. Indicator, Course ID–883/ASN.

Voltage requirements	115 volts ac ±11.5, 380–420 cps (two supplies).
Course bar:	
Deflection sensitivity	Meter movement calibrated for 5/8–0–5/8-inch deflection with 150–0–150-microampere input signal.
Input signal	Course deviation from navigation receiver.
To-from arrow:	
Actuator	250-ohm meter movement.
Actuating current	250-microamperes max.
Input signal	From navigation receiver.
COMPASS flag:	
Actuator	1,000-ohm meter movement.
Actuating current	Starts moving at 0.85 ma. Fully masked at 2.2 ma.

e. Gyroscope, Displacement CN–708/ASN.

Power requirements:	
Ac	115 volts ±11.5, 400 cps; 50 watts starting power and 20 watts running power. 26 to 30 volts, 400 cps, erection motor voltage; 6 watts power.
Caging voltage	28 volts ±2.8 dc.
Uncaging current	1.0 ampere.
Solenoid holding current	0.21 ampere max.
Outputs	Bank and pitch synchro signals. Bank and pitch reference signals.

f. Gyroscope, Rate CN–709/ASN.

Voltage requirements:
- Ac — 115 volts ±11.5, 400 cps.
- Dc — 27.5 volts ±2.75.

Outputs:
- Ac — 26 volts, 400 cps (switched) to erection motors of Gyroscope, Displacement CN–708/ASN.
- Dc — 28-volt (switched) cutoff bias voltage to the magnetic compass system.

5. Technical Characteristics of Coupler, Indicator CU–865/ASN

(fig. 1)

a. Power Requirements.

- Ac — 115 volts ±11.5, 380 to 420 cps, single phase, 0.6 ampere.
- Dc — 27.5 volts ±2.75, −5.5; 50 ma.

b. Input and Output Signals.

- Input — Dc course deviation voltage from navigation receiver.

Outputs:
- Vor course deviation signal. — ±dc voltage proportional to angular displacement of aircraft relative to the vor station.
- Localizer deviation signal. — ±dc voltage proportional to angular displacement of aircraft relative to the localizer pattern.
- To-from signal — ±dc voltage used to actuate to-from arrow in Indicator, Course ID–883/ASN.

6. Components

(fig. 1)

The components that make up the flight system are listed in the following charts (weights and dimensions of each component also are given):

a. Computer Set, Navigational AN/ASN–33 Components.

Component	Quantity	Height (in.)	Depth (in.)	Width (in.)	Weight (lb)
Computer, Navigational CP–583/ASN	1	7⅝	14 15/32	2¼	7. 0
Amplifier Assembly AM–2853/ASN	1	7⅝	14 15/32	2¼	5. 3
Indicator, Course ID–883/ASN	1	4.0	7¾	4.0	4. 6
Indicator, Attitude-Navigation ID–882/ASN	1	4.0	6¾	4.0	4. 2
Gyroscope, Rate CN–709/ASN	1	3⅝	8½	6¾	3. 3
Gyroscope, Displacement CN–708/ASN	1	5⅛	9¾	5⅞	7. 0
Mounting MT–2416/ASN	1	5⅞	16 7/64	5¼	2. 25

b. Other Components.

Component	Quantity	Height (in.)	Depth (in.)	Width (in.)	Weight (lb)
Coupler, Indicator CU–865/ASN	1	4⅝	9¼	5. 0	5. 1
Mounting MT–2417/ASN	1	1 19/32	9 13/32	5 15/16	0. 9

7. Common Names

A list of nomenclature assignments for Computer Set, Navigational AN/ASN–33, Coupler, Indicator CU–865/ASN, and Mounting MT–2417/ASN is given below. A common name is indicated after each item.

Nomenclature	Common name
Computer Set, Navigational AN/ASN–33 with Coupler, Indicator CU–865/ASN and Mounting MT–2417/ASN	Flight system
Computer, Navigational CP–583/ASN	Steering computer
Amplifier Assembly AM–2853/ASN	Instrument amplifier
Indicator, Course ID–883/ASN	Course indicator
Indicator, Attitude-Navigation ID–882/ASN	Approach horizon indicator
Gyroscope, Rate CN – 709/ASN	Sensor
Gyroscope, Displacement CN–708/ASN	Flight system vertical gyro
Mounting MT–2416/ASN	Computer and amplifier mounting
Coupler, Indicator CU–865/ASN	Vor coupler
Mounting MT–2417/ASN	Vor coupler mounting.

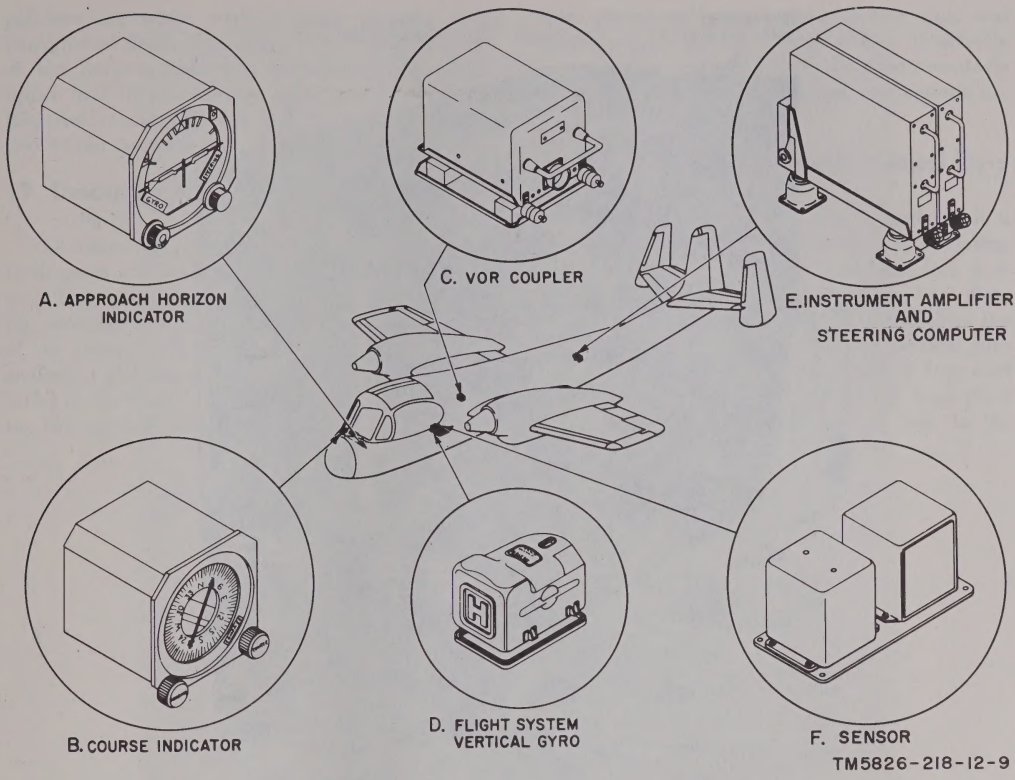


Figure 2. Typical installation of flight system components in fixed-wing aircraft.

8. Description of Flight System

The flight system consists of seven major equipment components secured in the aircraft. Three of these components have associated vibration-isolating-type mountings. All equipment is interconnected with multiconductor cables, for transferring signal data and power within the system. Figure 2 shows typical locations of the various components of the flight system as mounted in a fixed-wing aircraft. Physical descriptions of individual components are given in paragraphs 9 through 16.

9. Description of Instrument Amplifier

(fig. 3)

The instrument amplifier is housed in a rectangular metal case constructed of perforated metal to provide adequate cooling. The rear of the instrument amplifier contains two 32-pin connectors that engage receptacles mounted on the computer and amplifier mounting (par. 16*a*). The connectors provide electrical connections for the unit. The front panel has a holddown bracket that engages with one of the two knurled retainers (thumbscrews) at the front of the mounting. A handle is provided on the front panel to facilitate the engagement and disengagement of the electrical connectors when installing the instrument amplifier onto the mounting.

10. Description of Steering Computer

(fig. 3)

The steering computer is housed in a rectangular metal case similar to the instrument amplifier case (par. 9). The only external physical difference between the two units is that the steering computer has one 32-pin electrical connector at the rear instead of two.

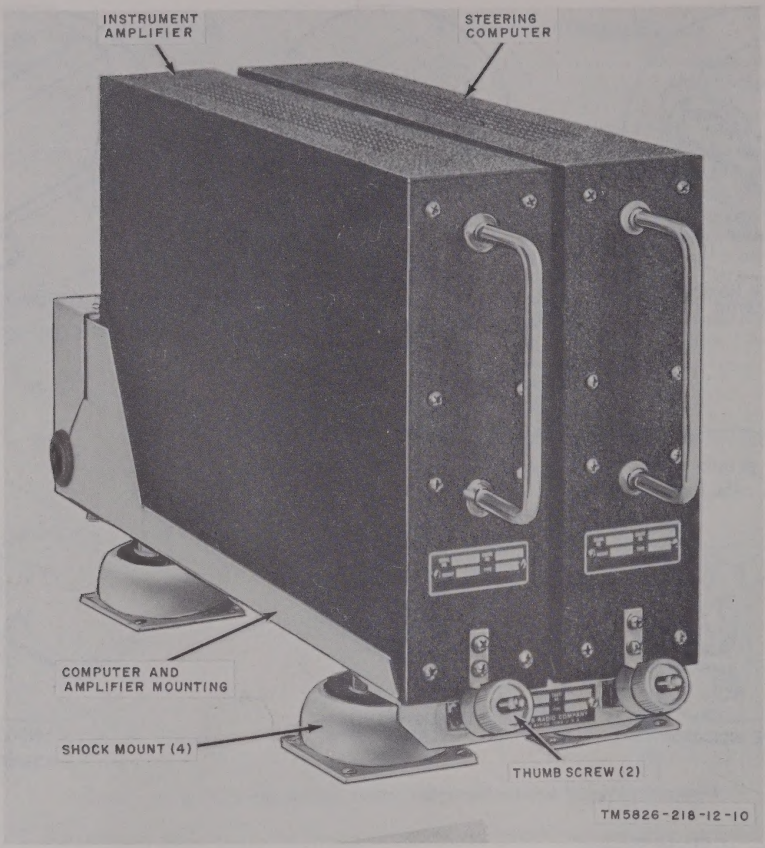


Figure 3. Instrument amplifier and steering computer installed in computer and amplifier mounting.

11. Description of Course Indicator

(fig. 4)

The course indicator is housed in a gray, aluminum, rectangular, container that has mitered edges along the four longitudinal corners of the dustproof enclosure. No integral mounting holes or attachments exist; however, the course indicator may be mounted on the aircraft instrument panel (A, fig. 2) from the front or rear by use of separate clamps and screws. The course indicator face (viewing end) contains seven movable indicators, a fixed lubber line, and two adjustment knobs. All indicators except the COMPASS flag, movable and fixed, are painted lusterless white to contrast with a black background. The COMPASS flag has black letters on a fluorescent red background. The course indicator has self-contained lamps for indirectly illuminating all the indicators. Electrical connections are made at the rear of the instrument housing through two 32-pin connectors.

12. Description of Approach Horizon Indicator

(fig. 5)

The approach horizon indicator is housed in a rectangular metal container similar to that of the course indicator and is mounted to the aircraft instrument panel (B, fig. 2). The face of the instrument contains eight movable indicators (four of which are warning flags), one fixed pointer, a dual five-dot scale, a switch, and one adjustment knob. The markings on the masks, disk, and

pointers are white with a black border. The background finish of the masks and the lower half of the horizon disk is a lusterless black. The upper half of the horizon disk is painted gray. Electrical connections are made to the unit through two 32-pin connectors at the rear.

13. Description of Sensor

(fig. 6)

The sensor (sensing unit) is a two-part assembly. Both parts are mounted together upon a common mounting plate that has four holes for installing the assembly in the aircraft (F, fig. 2). Each part of the assembly is housed in a rectangular metal enclosure and has an electrical connector (receptacle) at the front. Electrical connection between the two parts of the assembly is made with a short cable, permanently connected at one end, and terminating at the other end with a detachable connector that engages J2301, the fixed receptacle at that end. External electrical connections are made to J2302.

14. Description of Flight System Vertical Gyro

(fig. 7)

The flight system vertical gyro is enclosed in a semicylindrical, cast-metal housing. The housing is tightly sealed to prevent moisture and dust entering the unit, and is secured to the base plate with four wired fasteners. When installed in the aircraft (D, fig. 2), the flight system vertical gyro is mounted to the aircraft by means of four cast mounting flanges that are part of the base plate casting. Electrical connections are made to the

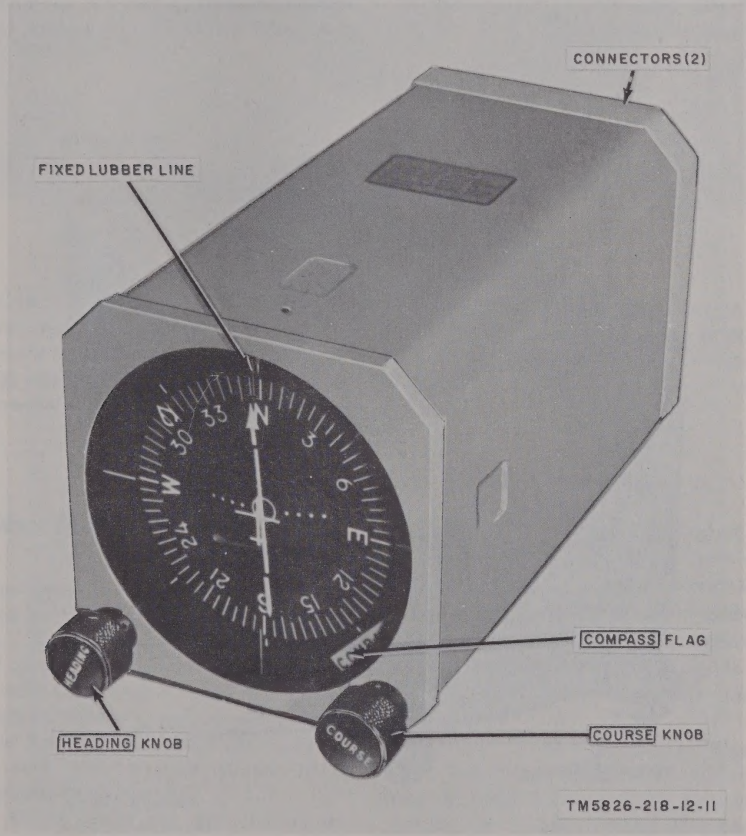


Figure 4. Course indicator.

unit through a sealed multipin connector that extends from the unit near the base.

15. Description of Vor Coupler

(fig. 8)

The vor coupler is housed in a rectangular, nonpressurized metal case. The front of the unit contains two holddown brackets at the bottom that engage with the two knurled retainers (thumbscrews) on the vor coupler mounting installed in the aircraft (C, fig. 2). Four test jacks, J1 through J4, across the lower portion of the front panel provide accessible test connection points for use by maintenance personnel. All electrical connections are made to the unit at the front through 41-pin connector P1.

16. Description of Mountings

a. Computer and Amplifier Mounting (fig. 3). The computer and amplifier mounting secures the instrument amplifier and steering computer in place between two sets of side rails. Guide pins are mounted at the rear of the computer and amplifier mounting to assure proper pin engagement between the fixed connectors on the mounting and those on the steering computer (one connector) and the instrument amplifier (two connectors). Four resilient vibration-isolating shock mounts, two at the front and two at the rear, provide mounting holes for attachment of the equipment to the aircraft. One of the four shock mounts is fitted with a grounding strap (not shown in fig. 3) to bond electrically the steering computer and instrument amplifier to the aircraft frame. Two knurled thumbscrew-type retainers (thumbscrews) are used to secure the units in place.

b. Vor Coupler Mounting (fig. 8). The vor coupler mounting consists of two aluminum plates that have their edges bent to increase strength and, in the case of the upper plate, to provide side

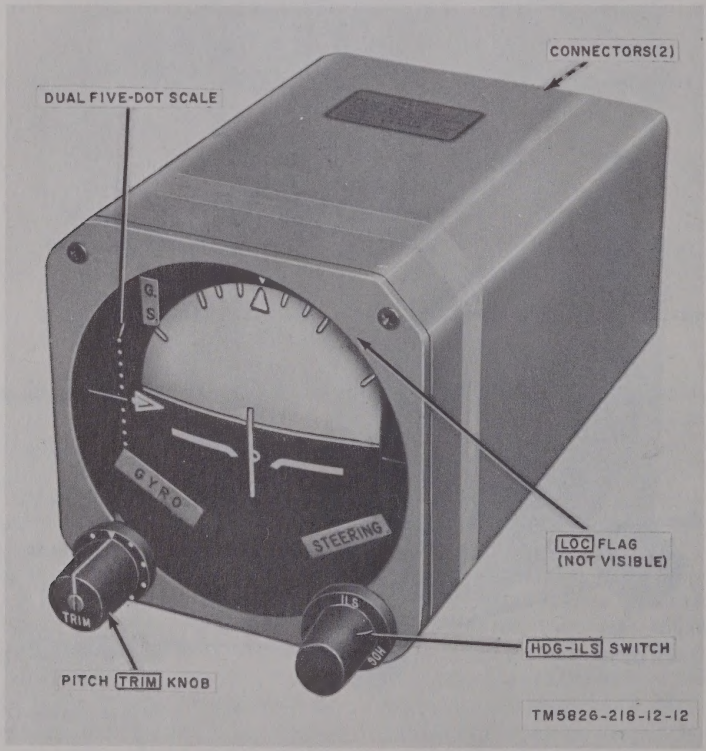


Figure 5. Approach horizon indicator.

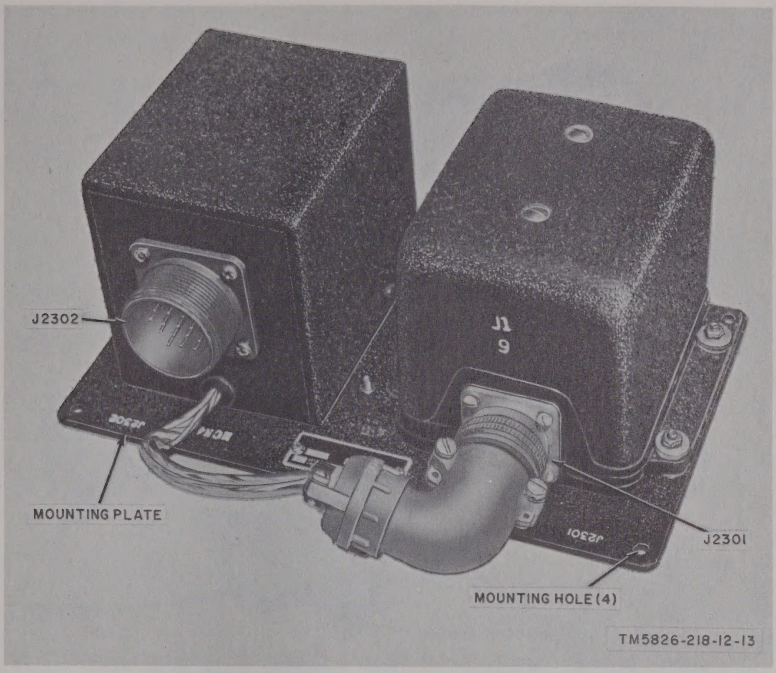


Figure 6. Sensor.

rails to retain the vor coupler. The upper and lower plates are separated with four resilient shock mounts and are connected electrically with a bonding (grounding) strap (not shown in fig. 8). The lower plate contains four holes, one at each corner, for attaching the vor mounting to the aircraft. Two knurled thumbscrew-type retainers (thumbscrews) are fastened to the front edge of the upper plate and are used to secure the vor coupler in place.

Section III. EQUIPMENT FUNCTIONS

17. Flight System Equipment Functions
(fig. 9)

Figure 9 illustrates the complete flight system (and associated equipment) in functional block diagram form. All operating signals are shown to provide the operator and organizational maintenance man with a basic, overall picture of the relationships between the various components of the integrated flight system. A brief functional description of each flight system component is given in paragraphs 18 through 24.

a. General. When integrated with the vor receiver, the magnetic compass system, and the glide slope receiver (if installed), the flight system provides complete flight information to the pilot. Omnirange or localizer information from the vor receiver, magnetic heading information from the magnetic compass system, and glide slope information from the glide slope receiver are used within the flight system to compute, and display continuously, aircraft attitude and deviation information.

b. Flight System Modes of Operation. The flight system can be operated in two modes: the heading (hdg) mode and the instrument landing system (ils) mode. When the vor receiver is tuned to an omnirange station, the computing circuits operate in the hdg mode. When the vor

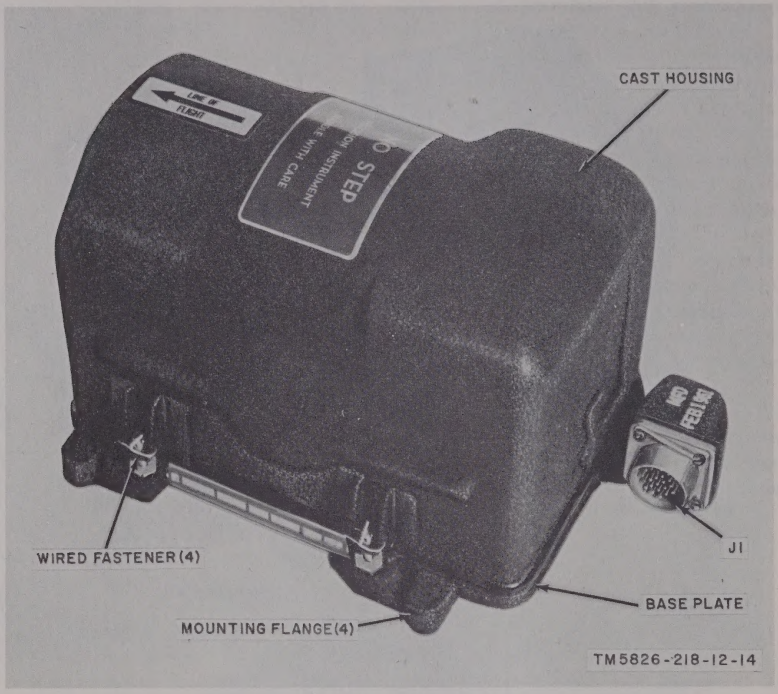


Figure 7. Flight system vertical gyro.

receiver is tuned to a localizer station, the computing circuits operate in the ils mode.

(1) *Hdg mode operation.* Computed information is used in the hdg mode to keep the aircraft on a selected heading. The selected heading error signal from the course indicator and the bank signal from the approach horizon indicator, representing bank data signals from the flight system vertical gyro, are used to produce the steering pointer signal that drives the steering pointer in the approach horizon indicator (fig. 10). The selected heading error signal is limited in the steering computer so that a bank of 10 to 30° will balance the error signal.

(2) *Ils mode operation.* Computed information is used in the ils mode to make an instrument landing approach to a runway. In this mode, the course arrow of the course indicator (fig. 11) is set to the bearing of the ils (localizer) beam. The localizer (loc) signal from the vor receiver is combined with a synthetic rate signal developed in the steering computer that approximates the rate at which the aircraft is approaching the localizer beam. The output of the steering computer is the steering pointer signal that drives the steering pointer in the approach horizon indicator (fig. 10).

18. Instrument Amplifier, Equipment Function (fig. 9)

The instrument amplifier is composed of four functional circuits: a compass servo channel, a bank servo channel, a pitch servo channel, and a flag circuit.

a. Compass Servo Channel. The compass servo channel receives a compass synchro error signal from the course indicator that represents compass data (magnetic heading information) from the magnetic compass. The output of the compass servo channel is a compass servomotor signal that drives the azimuth ring of the course indicator (fig. 11).

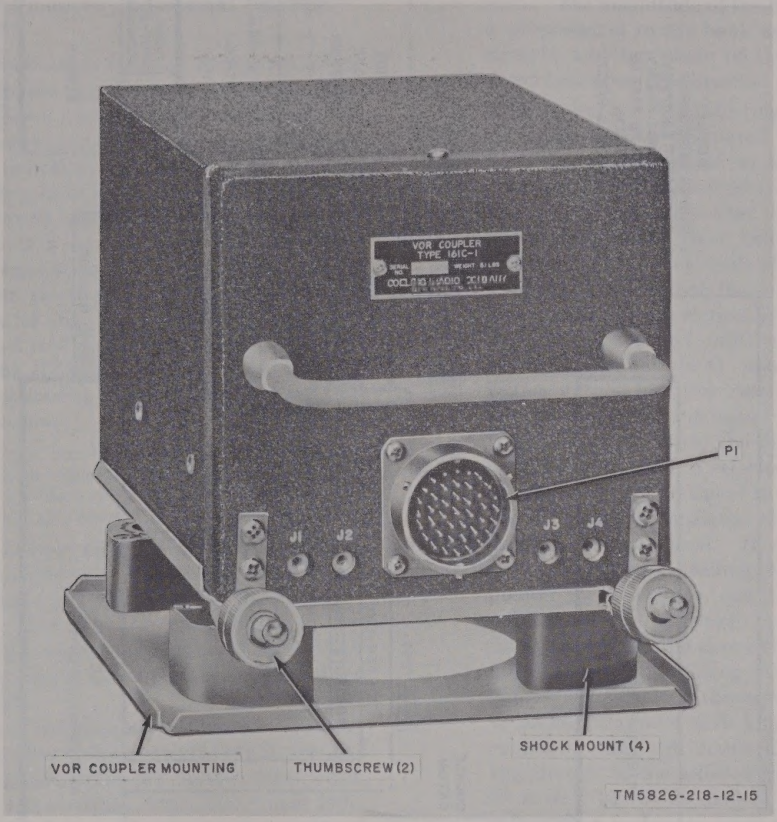


Figure 8. Vor coupler.

b. Bank Servo Channel. The bank servo channel receives a bank synchro error signal from the approach horizon indicator that represents bank data from the flight system vertical gyro. The output of the bank servo channel is a bank servomotor signal that drives the horizon disk of the approach horizon indicator (fig. 10).

c. Pitch Servo Channel. The pitch servo channel receives a pitch synchro error signal from the approach horizon indicator that represents pitch data from the flight system vertical gyro. The output of the pitch servo channel is a pitch servomotor signal that drives the pitch bar of the approach horizon indicator.

d. Flag Circuits. The flag circuits consist of two separate warning flag circuits as follows:

(1) *Gyro flag circuit.* The gyro flag signal operates the GYRO flag on the approach horizon indicator. This flag is masked (out of sight) whenever the gyro monitor signal from the flight system vertical gyro supplies the following information to the instrument amplifier: the pitch synchro error is less than 4.5°; the bank synchro error is less than 4.5°; attitude power (26 volts alternating current (ac)) is available; and the flight system vertical gyro is operating properly.

(2) *Compass flag circuit.* The compass flag signal operates the COMPASS flag on the course indicator (fig. 11). The COMPASS flag is masked (out of sight) when the compass servo channel is operating properly. If the compass servo channel becomes inoperative, the COMPASS flag will appear.

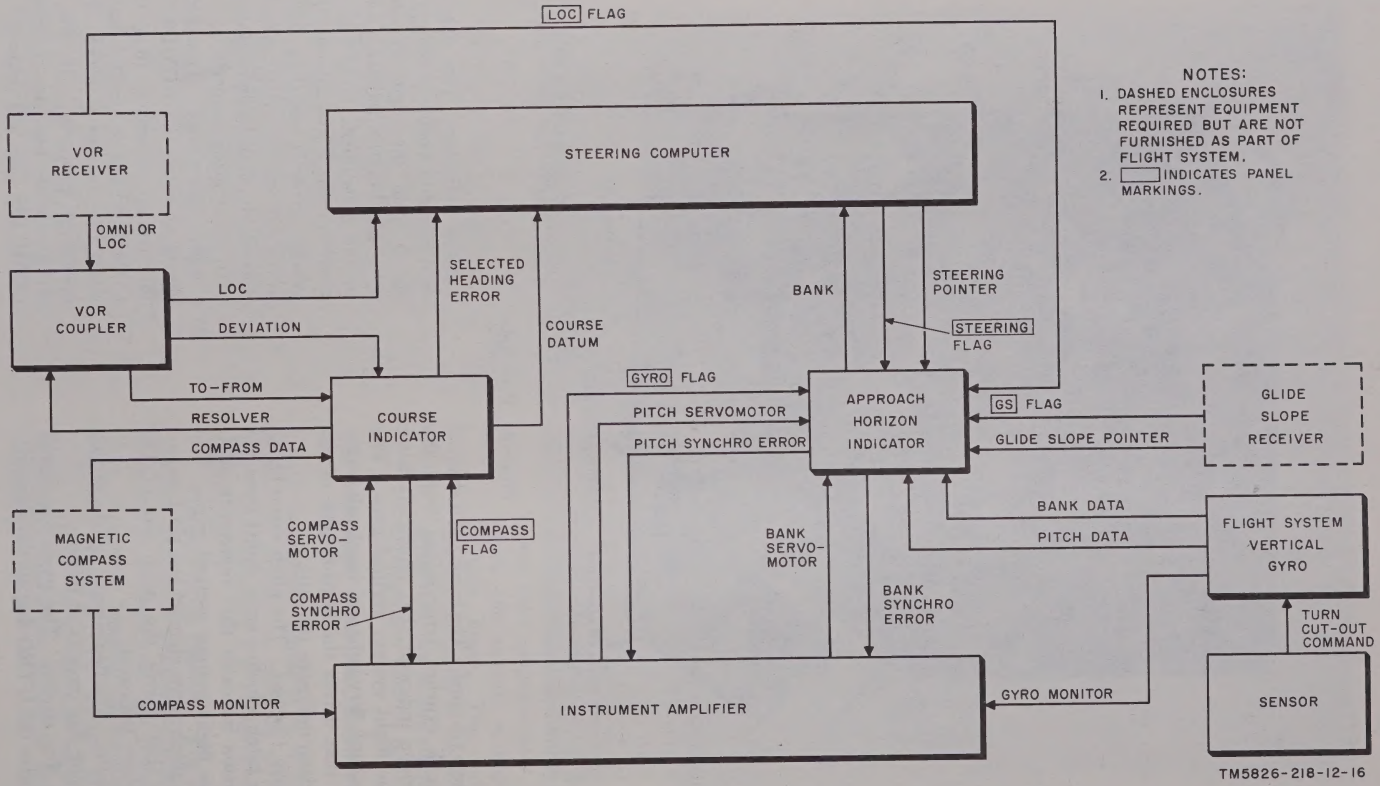


Figure 9. Flight system function diagram.

19. Steering Computer, Equipment Function (fig. 9)

a. Input Information Signals. Four input information signals are applied to the steering computer to develop a horizontal guidance signal; the vor receiver signal (omnirange (deviation) through the course indicator, or localizer (loc)), the selected-heading error signal, the bank signal, and the course datum signal. The steering pointer signal, which is a composite of the four input information signals, is the output signal and is applied to the steering pointer in the approach horizon indicator (fig. 10). A steering flag signal is also supplied to the approach horizon indicator to operate the STEERING flag. The steering computer functions in the hdg and ils modes of operation (*b* below).

Note: When the vor receiver is set for omnirange operation, the radio signal is referred to as the *deviation* signal. When the vor receiver is set for localizer operation, the radio signal is referred to as the *loc* signal.

(1) *Vor receiver signal.* The deviation or loc signal from the vor receiver is a direct-current (dc) voltage of reversible polarity. The signal is proportional to the actual angular displacement of the aircraft from the omnirange or localizer signal.

(2) *Selected-heading error signal.* The selected-heading error signal is a reversible-phase 400-cycle per second (cps) error voltage obtained from the course indicator. Selected-heading error signals are produced whenever the heading of the aircraft differs from the heading selected by the pilot. The phase of the error signal is determined by the direction of deviation from the selected heading.

(3) *Course datum signal.* The course datum signal is a reversible-phase 400-cps error voltage obtained from the course indicator. The error voltage has an amplitude proportional to the angular displacement of the magnetic heading of the aircraft from the selected course. The phase of the course datum signal is determined by the direction of deviation from the selected course.

(4) *Bank signal.* The bank signal is a reversible-phase ac signal from the approach horizon indicator that represents bank data from the flight system vertical gyro. The magnitude of the bank signal is proportional to the bank angle of the aircraft, and the phase of the signal is dependent upon the direction of bank.

b. Modes of Operation. The steering computer supplies an electronically computed horizontal guidance (steering pointer) signal to the steering pointer of the approach horizon indicator (fig. 10). A brief discussion of the two modes of operation of the steering computer is given below:

(1) *Hdg mode.* In the hdg mode of operation, information is derived from two of the four available input signals: the selected-heading error signal (*a*(2) above) and the bank signal (*a*(4) above). The course datum and vor receiver signals are not used. A bank signal is obtained that is proportional to the displacement of the aircraft from a selected magnetic heading. The bank signal is mixed with the selected-heading signal to obtain the steering pointer signal. If the aircraft is on the selected heading, the steering pointer signal is zero, and the steering pointer on the approach horizon indicator centers. If the aircraft is displaced from a selected heading, the steering pointer signal deflects the steering pointer to provide the pilot with a maneuvering command that will result in returning the aircraft to the selected heading.

(2) *Ils mode.* In the ils mode of operation, information is derived from three of the four available input signals: the course datum signal (*a*(3) above), the vor receiver signal (*a*(1) above), and the bank signal (*a*(4) above). The selected-heading error signal is not used in the ils mode. A bank command signal is obtained by combining a portion of the localizer deviation (loc) signal with a synthetic rate signal (par. 17*b*(2)). The synthetic rate signal approximates the rate at which the aircraft is approaching the desired localizer course. The loc signal is proportional to the amount of displacement from the desired localizer course. This bank command signal then is compared with the bank signal and the resultant is the steering pointer signal that is applied to the steering pointer of the approach horizon indicator (fig. 10).

20. Flight System Vertical Gyro, Equipment Function

(fig. 9)

The flight system vertical gyro consists of vertically mounted gyro synchros and erection motors. The vertical gyro contains a gimbalized rotor that is maintained in a vertical position with respect to the earth by an erection motor. Synchros attached to the rotor gimbals are used to translate rotor position into pitch data and bank data signals which are utilized by the flight system to indicate pitch and bank attitudes of the aircraft.

21. Sensor, Equipment Function

(fig. 9)

The sensor consists of a rate gyro and relay switching circuits. When the rate gyro senses that the maximum safe rate of turn has been exceeded, it supplies a turn cutout command signal to interrupt the application of power to the erection motors of the flight system vertical gyro. The power remains interrupted until the rate gyro senses that the turn is completed. A cutoff voltage (not shown in fig. 9) also is applied to the magnetic compass system gyro to prevent the gyro from being forced into a position oriented with the axis of the aircraft, rather than with the magnetic heading of the aircraft.

22. Vor Coupler, Equipment Function

(fig. 9)

The vor coupler connects the output of the vor receiver (either the deviation or loc signal) to the course indicator and to the steering computer. The vor coupler performs functions associated with the two types of signal operation as follows:

a. Omnirange Signal Operation. The deviation signal output of the vor receiver is fed to the vor coupler. This output, if other than zero, is converted into an ac signal that represents the heading to the vor station. A circuit in the vor coupler detects the difference between the course selected at the course indicator and the course being flown and supplies signal information to operate the course bar and the to-from arrow in the course indicator (fig. 11).

b. Localizer Signal Operation. In localizer operation, the vor receiver control unit (not shown) energizes a relay in the power relay module to connect the localizer signal from the vor receiver directly to the course bar in the course indicator.

23. Approach Horizon Indicator, Equipment Function

(fig. 9)

The approach horizon indicator presents a pictorial display of the pitch and bank attitude of the aircraft, similar to the standard artificial horizon. This instrument also integrates bank information derived from omnirange, localizer, or glide slope stations. (The glide slope facility is available only in aircraft equipped with a glide slope receiver.) In addition to the external controls and indicators (fig. 10), the instrument contains bank indication circuits, pitch indication circuits, glide slope indication circuits, steering pointer meter movement, and warning flag circuits.

a. Bank Indication Circuits. The bank of the aircraft is displayed by the horizon disk which is positioned by a servomotor in the approach horizon indicator (fig. 10). The servomotor is driven by the bank servomotor signal from the instrument amplifier.

b. Pitch Indication Circuits. The pitch attitude of the aircraft is displayed by the pitch bar in the approach horizon indicator. The pitch bar is servomotor-driven and mechanically positioned. The servomotor is driven by the pitch servomotor signal from the instrument amplifier.

c. Glide Slope Deviation Circuits. The glide slope signal from the glide slope receiver drives the glide slope pointer in the approach horizon indicator to show the vertical position of the aircraft above or below the glide slope beam.

d. Warning Flag Circuits. The approach horizon indicator contains four of the five flight system warning flags that respond to circuits throughout the flight system as follows:

(1) *Glide slope warning flag circuit.* In aircraft equipped with a glide slope receiver (Receiver Group AN/ARA–54), the GS flag signal masks the GS flag to indicate that power is applied to the glide slope receiver. The GS flag will be unmasked (visible) on all aircraft not equipped with a glide slope receiver.

(2) *Gyro warning flag circuit.* The flight system vertical gyro generates a GYRO flag signal to control the GYRO flag. If the flight system vertical gyro stops operating, the GYRO flag signal is interrupted and the GYRO flag is unmasked.

(3) *Steering warning flag circuit.* The STEERING flag signal unmasks the STEERING flag if either or both attitude and heading signals are lost.

(4) *Localizer warning flag circuit.* The vor receiver supplies the loc signal to maintain the LOC flag out of sight as long as the received signal is of sufficient amplitude. When the signal drops below a predetermined level, the LOC flag is unmasked to advise that the indications are probably erroneous.

24. Course Indicator, Equipment Function (fig. 9)

The course indicator provides information concerning the relative position and heading of the aircraft with respect to magnetic north, and a selected course of an omnirange (vor) station. In addition to the external controls and indicators (fig. 11), the instrument contains magnetic heading circuits, course deviation circuits, and compass warning flag circuit.

a. Magnetic Heading Circuits. The magnetic heading of the aircraft is displayed by the azimuth ring which is positioned by a servomotor. If the magnetic heading changes, a compass synchro error signal is amplified in the instrument amplifier, phase-shifted and applied back to the servomotor in the course indicator as the compass servomotor signal. The servomotor then drives the azimuth ring until no compass synchro error signal exists. The azimuth ring therefore continuously displays the magnetic heading of the aircraft regardless of the course being flown.

b. Course Deviation Circuits. A deviation signal and a to-from signal are supplied from the vor receiver through the vor coupler to the course indicator circuits.

(1) The deviation signal from the vor receiver is applied through the vor coupler to the course bar meter movement in the course indicator. When the vor receiver is tuned to a vor station, the desired vor radial is selected by rotating the course arrow with respect to the azimuth ring on the course indicator (fig. 11). The course arrow is mechanically connected to a synchro resolver which inserts the selected course data (resolver signal) into the vor receiver. The receiver then develops the deviation signal that drives the course bar.

Note. When the receiver is tuned to a localizer signal, the deviation signal to the course bar is developed independently of the resolver signal (par. 22*b*).

(2) The to-from meter movement of the course indicator (fig. 11) is driven by a to-from signal generated in the vor receiver. The polarity of the signal is determined by the position of the aircraft with respect to the vor station and by the selected course. Because an aircraft heading that is 180° away from a vor station will produce the same course bar indication, the to-from arrow prevents ambiguous readings by pointing to the vor station always.

Note. The to-from arrow is not visible when operating in the ils mode.

c. Compass Warning Flag Circuit. The compass monitor signal from the magnetic compass is applied through the instrument amplifier and to the course indicator as the compass flag signal. If this signal level drops below a predetermined value, the COMPASS flag appears and indicates that the magnetic heading information may be erroneous.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. OPERATOR'S CONTROLS AND INDICATORS

25. Approach Horizon Indicator
(fig. 10)

Control or indicator	Function
Bank pointer	A fixed pointer that operates with horizon disk to indicate the amount of bank in increments of 10, 20, 30, and 60°.
Horizon disk	Rotates against fixed bank pointer to indicate the amount of bank.
Horizon bar (part of horizon disk).	Indicates the bank attitude of the aircraft, independent of pitch, in relation to the horizon.
Pitch bar	Moves up and down to display the pitch attitude of the aircraft with respect to the horizon bar. Pitch bar above the horizon bar indicates noseup attitude; pitch bar below horizon bar indicates nosedown attitude.
Pitch TRIM knob	Permits selection of pitch attitude other than horizontal. In hdg mode, the pitch TRIM adjustment range is +20 to −15° in 5° increments. In ils mode, pitch trim is preset to the normal approach attitude. Maximum pitch range is 85° above or below the horizon.
Glide slope pointer	Moves up or down to show displacement of the aircraft above or below the glidepath on a 5-dot vertical scale. During an ils approach, the position of the glide slope pointer with respect to the pitch bar is a pitch command. The aircraft is on the glidepath when the glide slope pointer is at center.
Steering pointer	Deflects right or left to provide aircraft position information relative to a selected course or localizer beam. Right deflection is a command to bank to the right; left deflection is a command to bank to the left.
HDG-ILS switch	Used to select the flight function (heading mode or instrument landing system mode). The switch is placed in the same relative function as the corresponding vor receiver function control setting (omnirange or localizer).
GYRO flag	When visible, indicates that signals from the flight system vertical gyro are not reliable.
LOC flag	When visible, indicates that signals from the vor receiver are not reliable.
STEERING flag	When visible, indicates that signals from the steering computer are not reliable.
GS flag	When visible, indicates that signals from the glide slope receiver are not reliable. On aircraft not having a glide slope receiver installed, the GS flag is always visible and serves no useful purpose.

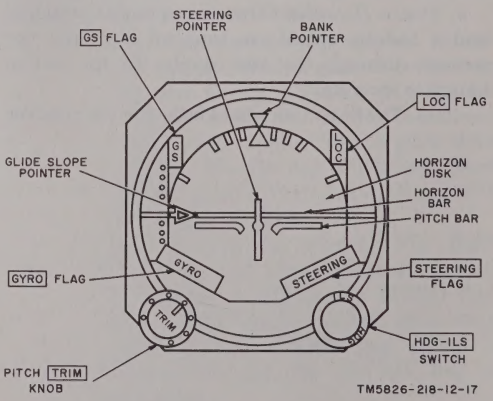


Figure 10. Approach horizon indicator, operator's controls and indicators.

26. Course Indicator
(fig. 11)

Control or indicator	Function
Azimuth ring	Rotates against the lubber line to indicate the aircraft heading with respect to magnetic north.
Heading marker	Set with HEADING knob against azimuth ring to indicate the selected magnetic heading. Displacement of the heading marker from the lubber line shows the direction and amount of deviation from the magnetic heading selected by the HEADING knob. Once set, the heading marker rotates with the azimuth ring to provide a continuous display of selected heading and heading variation.
Lubber line	A fixed pointer that indicates the aircraft heading (actual).
Course arrow	Set with COURSE knob against azimuth ring to indicate the selected vor radial or localizer course.
Course bar	Moves right or left of course arrow on 5-dot scale to indicate the deviation from the selected course (one dot deflection represents 2° deviation). The aircraft is on the selected course when the course bar aligns with the head and tail of the course arrow.
To-from arrow	Revolves about center to point toward the vor station. The to-from arrow will not be visible when operating in the ils mode.
Miniature airplane	Indicates relative position of the aircraft with respect to the selected course. The miniature airplane is permanently aligned with the lubber line.
HEADING knob	Used to set the heading marker to a desired magnetic heading on the azimuth ring.
COURSE knob	Used to set the course arrow to a desired vor radial or localizer course on the azimuth ring.
COMPASS flag	When visible, indicates that signals from the magnetic compass system are not reliable.

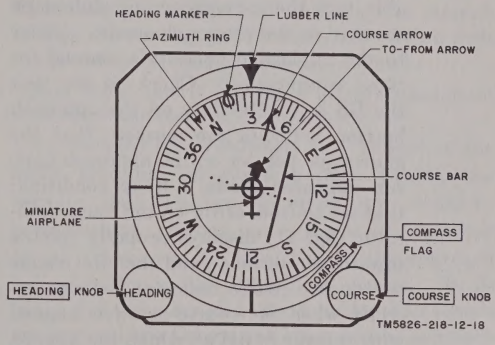


Figure 11. Course indicator, operator's controls and indicators.

Section II. FLIGHT SYSTEM OPERATION

27. Preliminary Operations

a. Starting Procedure. In a typical aircraft flight system equipment installation, power is supplied to the equipment through the aircraft power circuit breaker panel. Refer to the operator's manual for the aircraft in which the equipment is installed for instruction in energizing the flight system and associated equipment.

b. Pilot's Preflight Operational Check. Before the aircraft is airborne, the pilot should perform the following operational checks on the flight system:

(1) Turn on the vor receiver, magnetic compass system, and glide slope receiver. Refer to the operator's manual for the aircraft in which the equipment is installed.

(2) Energize the flight system by operating the aircraft circuit breakers and wait approximately 3 minutes; then check to see that the GYRO and STEERING flags on the approach horizon indicator (fig. 10) and the COMPASS flag on the course indicator (fig. 11) are masked (not visible).

(3) Set the HDG-ILS switch on the approach horizon indicator to HDG.

(4) Use the HEADING knob on the course

indicator to move the heading marker approximately 90° from the lubber line. The steering pointer on the approach horizon indicator (fig. 10) should deflect in a corresponding direction.

(5) Use the HEADING knob on the course indicator (fig. 11) to return the heading marker to the lubber line. The steering pointer on the approach horizon indicator (fig. 10) should center.

(6) Set the HDG-ILS switch on the approach horizon indicator to ILS.

(7) Turn the COURSE knob on the course indicator (fig. 11), until the course arrow moves 5°, then return quickly to the lubber line. The steering pointer on the approach horizon indicator (fig. 10) should deflect abruptly and return to center slowly.

(8) If ground vor and ils facilities are available, tune the vor receiver and glide slope receiver to the proper channels. (Refer to the applicable operator's manual for these equipments.) Check to see that the GS and LOC flags on the approach horizon indicator are masked; that the glide slope pointer on the approach horizon indicator shows a flyup condition; that the to-from arrow on the course indicator (fig. 11) displays properly (points toward vor station); and that the course bar on the course indicator centers correctly when the course arrow is aligned with the vor radial on which the aircraft is located.

(9) Check the azimuth ring on the course indicator for proper followup to the magnetic compass during taxiing.

(10) Check the pitch bar and horizon bar on the approach horizon indicator (fig. 10) for correct indication of aircraft ground attitude.

(11) Set the HDG-ILS switch on the approach horizon indicator to HDG before takeoff.

28. Basic Flight System Operations

This paragraph contains discussions of the basic operations and instrument indications used by the pilot when performing the various flight procedures. A thorough understanding of the basic operations and associated instrument indications should be attained before attempting to perform the flight procedures in this manual (par. 30 through 39).

a. Hdg and Ils Modes. The hdg mode is used for each procedure except ils final approach (par. 37). The pitch bar on the approach horizon indicator (fig. 10) is referenced to the cruise attitude of the aircraft in the hdg mode. When making an ils final approach, the pilot changes to ils mode after alignment with the localizer outside the outer marker inbound. In ils mode, wind drift is compensated for automatically and the pitch bar is referenced to the aircraft approach attitude. Match the pitch bar and glide slope pointer on the approach horizon indicator (fig. 10) at the center of the vertical five-dot scale to follow the glidepath to breakout.

b. Steering Pointer Operation. When the steering pointer on the approach horizon indicator (fig. 10) moves to the left, the pilot will turn to the left or reduce the amount of right turn; when the steering pointer moves to the right, the pilot turns to the right or reduces the amount of left turn. The aircraft is always flown *into* the steering pointer or banked towards the steering pointer. A bank angle of 15° to 30° (depending on preset bank limit control) is the maximum required to center the needle. The steering pointer returns to center when the aircraft is banked correctly. The steering pointer is held at center for a smooth rollout from a turn into a new heading.

c. Pitch Bar Operation. In hdg mode, the aircraft cruise attitude is determined by comparing the pitch bar with the horizon bar on the approach horizon indicator (fig. 10), similar to conventional artificial horizon procedure. A level cruise attitude indication can be adjusted with the pitch TRIM knob on the approach horizon indicator. In ils mode, the aircraft is in the correct approach attitude when the pitch bar is centered. In the ils final approach and go-around procedure (par. 37), the pilot switches to hdg mode for normal pitch bar indication.

d. Selecting, Turning to Heading. With HDG-ILS switch at HDG on the approach horizon indicator (fig. 10), the HEADING knob on the course indicator (fig. 11) is used to set the heading marker at the desired heading on the azimuth ring. The aircraft should be banked toward the steering pointer until the steering pointer centers (*b* above). The amount of bank called for by the steering pointer is limited to a safe bank angle. If the aircraft makes a steeper bank entry than this predetermined limit, the steering pointer will

move past center on its return to alert the pilot to ease his bank. When the aircraft is within safe bank limit range of the selected heading, the bank angle called for by the steering pointer will decrease gradually as the heading error decreases, and the aircraft will roll out smoothly on the new heading.

e. Selecting and Holding Vor Course. The vor receiver is tuned to the desired vor station and the COURSE knob on the course indicator (fig. 11) is used to set the course arrow to the course to be followed. A course of 45° (A, fig. 12) has been set with the course arrow, and the course bar is displaced *left* to the fourth dot (first dot is represented by the circle around the miniature airplane), indicating that the vor radial selected is to the left of the present aircraft heading. The to-from arrow is shown pointing towards the vor station. The HEADING knob on the course indicator is used to set the heading marker to the heading required to approach the selected course; reset as necessary to hold the course. The aircraft is flown to keep the steering pointer on the approach horizon indicator (fig. 10) centered to hold the headings set by the heading marker. As the aircraft is flown onto the new heading, the course bar will align itself with the head and tail of the course arrow and the course arrow will be aligned with the heading marker and lubber line.

f. Holding Heading. If the aircraft deviates from a preset heading, the steering pointer on the approach horizon indicator will be deflected to call for a bank in the direction that will correct the error. In B, figure 12, the bank pointer scale shows that the aircraft is in a 15° right bank attitude and the steering pointer is centered to show that the steering pointer deflection that called for the bank has been corrected. When flying a preset heading, the amount of bank required to correct for heading deviation is usually small. The bank angle required to center the steering pointer will be proportional to the heading deviation and will decrease as the correct heading is approached.

g. Wind Drift Correction. In the hdg mode, correction for wind drift can be made with the HEADING knob on the course indicator (fig. 11) to offset the heading marker upwind from the course arrow. A typical offset for wind correction is shown in C, figure 12. If the aircraft drifts away from the course bar (as evidenced by course bar displacement), adjust the heading marker to the heading that will hold the aircraft on course. The heading is maintained by flying the aircraft to keep the steering pointer centered. Wind drift compensation is automatic in the ils mode.

Note: Wind drift is not shown in the typical flight procedure illustrations (fig. 15 through 24).

h. Warning Flag Interpretation. In each of the flight procedure illustrations (figs. 15–24), the warning flags are not shown on the indicator presentations. In hdg mode, if a satisfactory vor signal is received, the LOC flag on the approach horizon indicator (fig. 10) will be masked. In ils mode, if satisfactory glide slope and localizer signals are received, the GS and LOC flags on the approach

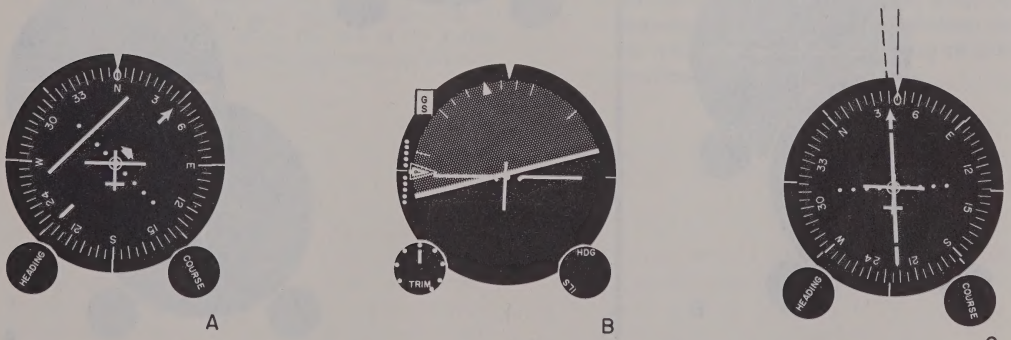


Figure 12. Instrument interpretation.

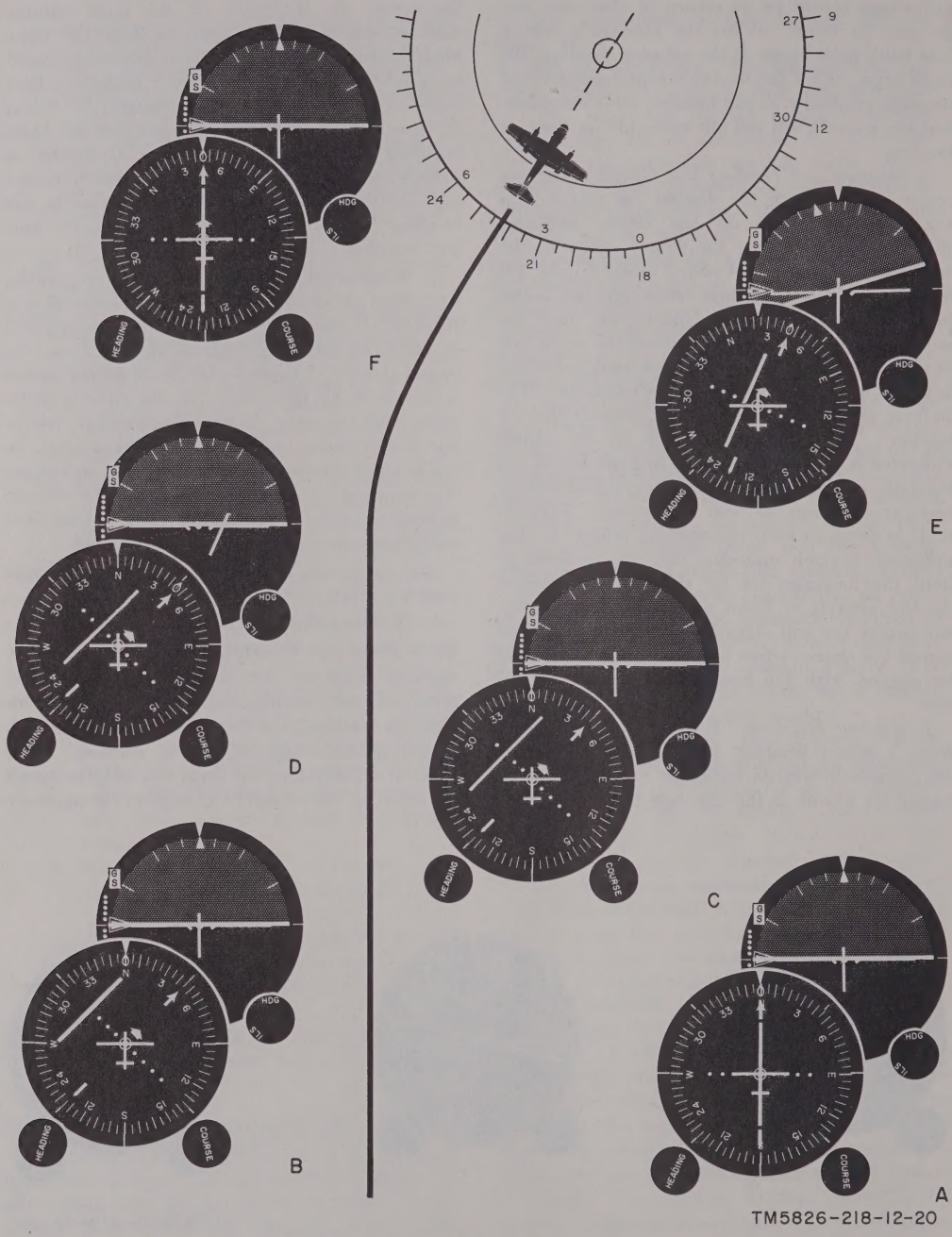


Figure 13. Intercepting and flying a vor radial.

horizon indicator will be masked. The STEERING and GYRO flags on the approach horizon indicator, and the COMPASS flag on the course indicator (fig. 11) will be masked if the steering computer, flight system vertical gyro, and magnetic compass system are operating properly.

29. Typical Flight System Indications During Flight

a. Intercepting and Flying Vor Radial (fig. 13). The sequence of indicator presentations and procedures related to the selection and interception of a vor radial are given below. The combined indications of the approach horizon and course indicators advise the pilot of the flight situation, and indicate the action necessary to fly the aircraft on the selected course.

(1) In A, figure 13, the flight system is in the hdg mode and the course indicator shows that the aircraft is on a 0° (north) heading.

(2) In B, figure 13, the vor receiver has been tuned to a vor station, the COURSE knob on the course indicator has been turned until the course arrow points to the bearing of the selected vor radial (45° in the example shown).

(3) In D, figure 13, the HEADING knob on the course indicator has been turned so that the heading marker points to the bearing of the selected radial (45°). The steering pointer on the approach horizon indicator is shown deflected to the right to command a right bank and a rollout on the selected vor radial heading.

Note. In C, D, and E, figure 13, the course bar (which represents the direction of the selected vor radial away from the flightpath) is shown moving across the face of the course indicator as the aircraft approaches the selected radial.

(4) In E, figure 13, the bank pointer on the approach horizon indicator shows 15° of bank, and the steering pointer is centered to indicate that the aircraft is making the correct turn to the selected heading.

(5) In F, figure 13, both indicators show that the aircraft is on the 45° heading selected in (2) above and is proceeding in level flight attitude.

b. Vertical and Lateral Guidance in Ils Mode. The approach horizon indicator presentations (A and B, fig. 14) show the glide slope pointer and steering pointer indications for the flight conditions illustrated. Follow the procedures in (1) and (2) below to perform vertical and horizontal guidance in the ils mode (HDG-ILS switch on the approach horizon indicator (fig. 10) at ILS).

(1) *Vertical guidance.* The position of the glide slope pointer on the approach horizon indicator (A, fig. 14) shows that the aircraft is above the glidepath. To fly the aircraft onto the glidepath, nose the aircraft down until the pitch bar is opposite the glide slope pointer. To stay in the correct vertical approach attitude, keep the pitch bar and glide slope pointer matched at center scale and follow the glidepath to breakout.

(2) *Lateral guidance.* The deflection of the steering pointer to the right (B, fig. 14) shows that the aircraft is to the left of the localizer beam. To fly the aircraft to the centerline of the localizer beam, bank the aircraft toward the steering pointer (to the right) until the steering pointer is centered. To insure a correct approach that eliminates bracketing, fly the aircraft to keep the steering pointer centered.

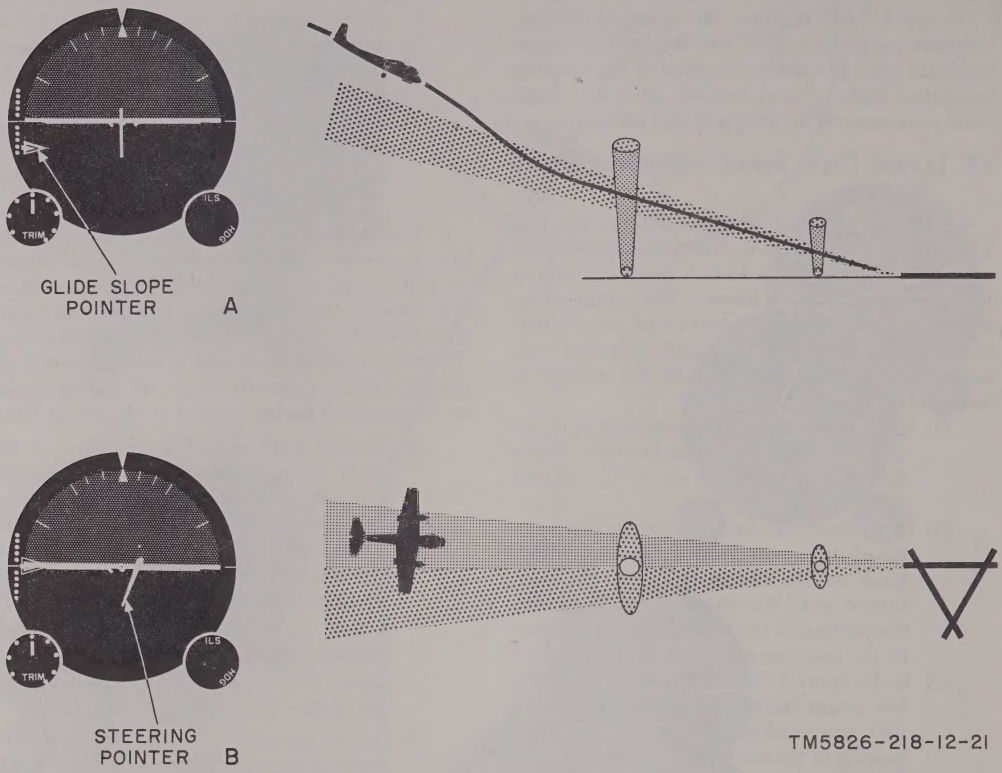


Figure 14. Vertical and lateral guidance in ils mode.

Section III. TYPICAL FLIGHT PROCEDURES

Note. The flight procedures outlined in this section represent typical uses that utilize the capabilities of the flight system. It is not intended that the procedures will obviate or supersede any existing flight procedures; neither do they establish or represent mandatory, or approved, new flight procedures.

30. Climb-Out and Dead Reckoning Navigation

To perform climb-out and dead reckoning navigation, follow the procedures indicated below.

a. Climb-Out (A, fig. 15).

(1) Perform the preliminary operations (par. 27).

(2) After takeoff, establish climb attitude by comparing the pitch bar with the horizon bar on the approach horizon indicator (fig. 10). In A, figure 15, the pitch bar on the approach horizon indicator shows a noseup attitude.

(3) Use the HEADING knob on the course indicator (fig. 11) to set the heading marker to the desired heading. In A, figure 15, the heading marker on the course indicator is aligned with the lubber line and the aircraft is on a 120° heading.

(4) Keep the steering pointer on the approach horizon indicator (fig. 10) centered.

(5) Use the COURSE knob on the course indicator (fig. 11) to set the course arrow to the cruise course. In A, figure 15, the course arrow is shown set to a cruise course of 150°.

b. Dead Reckoning Navigation (B, fig. 15).

(1) Use the HEADING knob on the course indicator to set the heading marker to the desired heading; turn to and hold the selected heading by flying the aircraft to keep the steering pointer on the approach horizon indicator centered. In B, figure 15, the course indicator shows that the heading marker has been set to a heading of 150° (selected by the course arrow) and the aircraft has been flown onto this new heading.

(2) Refer to the pitch bar on the approach horizon indicator and adjust attitude deviations as necessary.

31. Var Navigation

To perform var (visual-aural very high-frequency (vhf) radio range) navigation, follow the procedures indicated below.

a. Approaching Course (A, fig. 16).

(1) Tune the vor receiver to the var station.

(2) Use the COURSE knob on the course indicator (fig. 11) to set the course arrow to the westbound or southbound visual course. In A, figure 16, the course arrow is set to the westbound (270°) visual course. The course bar will deflect in the direction of the visual course.

(3) Use the HEADING knob on the course indicator to set the heading marker to a

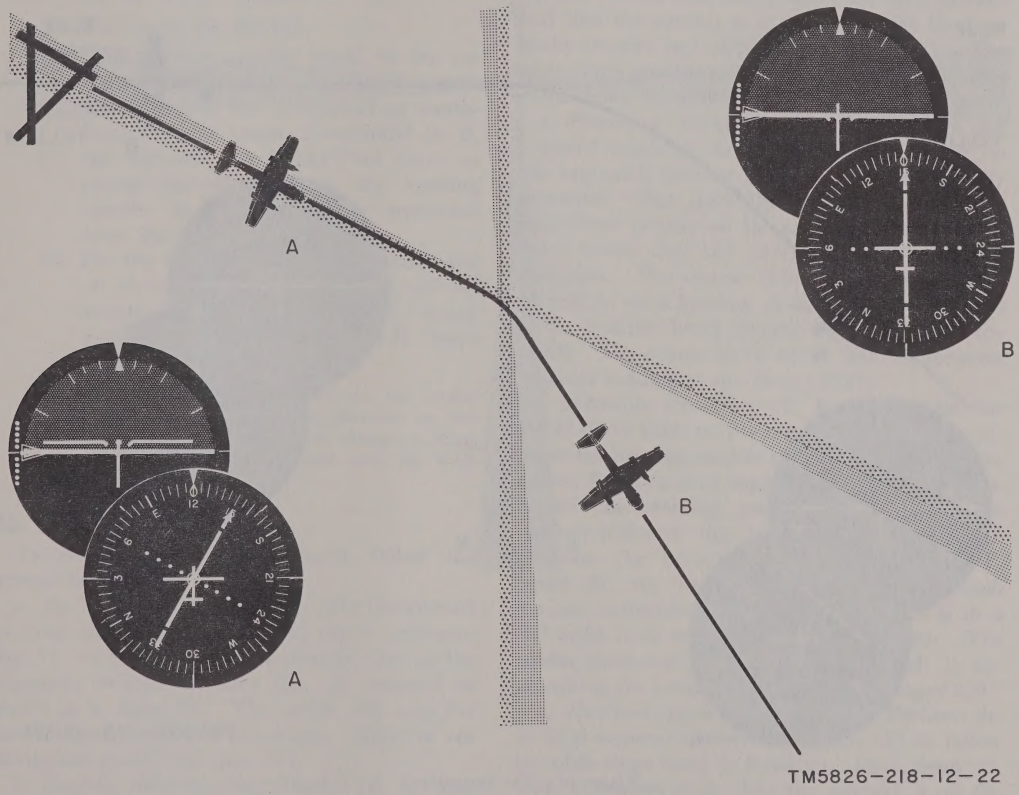


Figure 15. Climb-out and dead reckoning navigation.

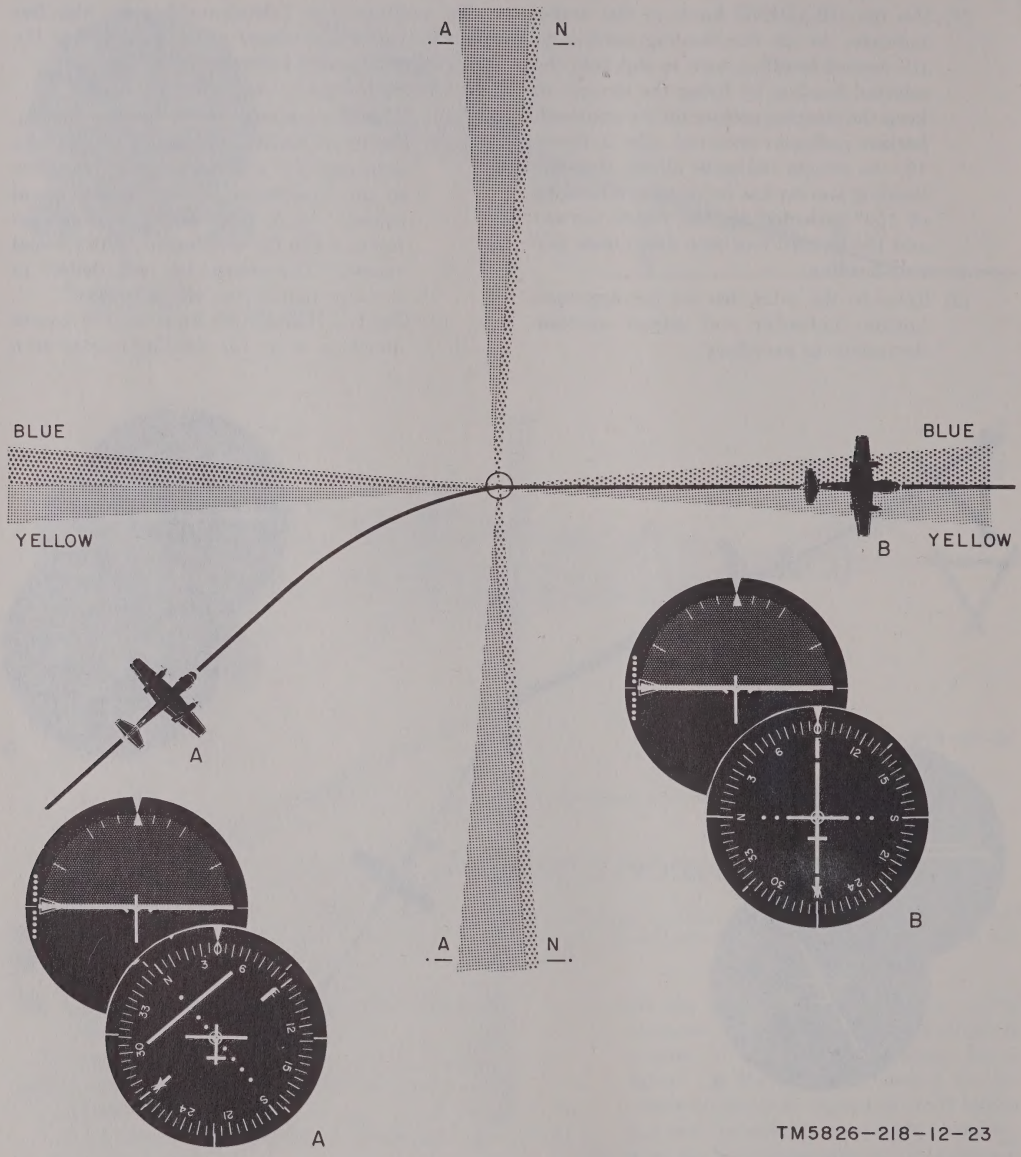


Figure 16. Var navigation.

heading that will *intercept* the visual course (40°, A, fig. 16).

(4) Keep the steering pointer on the approach horizon indicator (fig. 10) centered to approach the course. The course bar will approach alinement with the course arrow.

(5) Just before the course bar on the course indicator (fig. 11) centers (alines with the course arrow), use the HEADING knob to aline the heading marker with the desired course.

(6) To turn the aircraft onto the visual course, fly the aircraft to center the steering pointer on the approach horizon indicator and center the course bar on the course indicator.

b. On Var Course (B, fig. 16).

(1) With the vor receiver tuned to the var station (*a*(1) above) and the course arrow set to the westbound or southbound visual course (westbound in B, fig. 16), use the HEADING knob on course indicator to set the heading marker to compensate for crosswind (par. 28*g*).

(2) Fly the aircraft to keep the course bar on the course indicator centered and the sterring pointer on the approach horizon indicator centered as shown in B, figure 16.

Note. The to-from arrow on the course indicator (fig. 11) will not function on var stations. Aural signal (N–A) changes indicate that the aircraft has passed over the VAR station.

32. Typical Approach

To perform a typical approach, follow the procedures indicated below.

a. On Vor Course (A, fig. 22). Fly the aircraft to keep the course bar on the course indicator (fig. 11) centered, and the steering pointer on the approach horizon indicator (fig. 10) centered as shown in A, figure 22. This action will keep the aircraft on the selected vor course. Refer to vor navigation procedures (par. 33).

b. Heading Select to Outer Marker (B, fig. 22). Use the HEADING knob on the course indicator (fig. 11) to set the heading marker to the heading obtained from a radio fix that will intersect the outer marker. In B, figure 22, the heading marker has been set to a heading of 310° and the steering pointer is deflected to the left to command a left turn to the new heading.

c. Flying to Outer Marker (C, fig. 22). Turn the aircraft to the new heading; fly the aircraft to keep the steering pointer on the approach horizon indicator (fig. 10) centered. In C, figure 22, the bank pointer on the approach horizon indicator shows that the aircraft is in a 30° left bank attitude and turning toward the new heading selected by the heading marker (*b* above).

d. Localizer Course Select (D, fig. 22). Tune the vor receiver to the ils radio channel and select the localizer course. (Refer to the applicable operator's manual for the tuning procedure.) Refer to ils approach procedures (par. 36). In D, figure 22, the course indicator shows that the aircraft is on the 310° course that will intersect the outer marker and that the aircraft is to the left of the localizer beam (course bar displaced to the right). The glide slope pointer on the approach horizon indicator shows the aircraft to be below the glidepath.

e. Procedure Turns (E, fig. 22). Select the required headings; keep the steering pointer on the approach horizon indicator centered and fly procedure turns (par. 36). In E, figure 22, the glide slope pointer on the approach horizon indicator shows that the aircraft is still below the glidepath. The course indicator shows that the aircraft is on a heading of 40° and is to the left of the localizer beam (course bar displaced to the right). The course arrow shows that the localizer inbound heading is due West (270°).

f. Alternate Procedure (F, fig. 22). Use the HEADING knob on the course indicator (fig. 11) to set the heading marker at the head of the course arrow; fly procedure turn path by picture. Disregard the steering pointer on the approach horizon indicator (fig. 10) until the aircraft approaches the inbound localizer course. In F, figure 22, the bank pointer on the approach horizon indicator shows that the aircraft is in a 30° right bank and is below the glidepath. The course indicator shows that the aircraft is approaching the localizer beam on a heading of 230°.

g. Ils Final Approach (G, fig. 22). Perform the ils final approach procedures (par. 37) to follow the glide slope beam to breakout. In G, figure 22, both indicators show that the aircraft is on the inbound localizer centerline and glidepath.

h. Crosswind Correction (H, fig. 22). Fly the aircraft to keep the steering pointer on the approach horizon indicator (fig. 10) centered. Correction for crosswind is automatic in ils final

approach when the steering pointer is kept centered. In H, figure 22, the indicators show that the aircraft is still on the localizer centerline and glidepath.

33. Vor Navigation

To perform vor navigation, follow the procedures below.

a. Flying to Vor Station (A, fig. 23).

(1) Tune the vor receiver to the vor station. (Refer to the applicable operator's manual for tuning procedure.)

(2) Rotate the COURSE knob on the course indicator (fig. 11) until the course bar centers and the to-from arrow points toward the head of the course arrow.

(3) Use the HEADING knob on the course indicator to set the heading marker in coincidence with the course arrow.

(4) Turn the aircraft to the vor course selected and track the course; fly the aircraft to keep the steering pointer on the approach horizon indicator (fig. 10) centered. In A, figure 23, the course indicator shows that the aircraft is approaching the vor station on an approximate heading of 230°.

(5) Use the HEADING knob on the course indicator (fig. 11) to adjust the heading marker for wind correction (par. 28*g*).

(6) Fly the aircraft to keep the steering pointer on the approach horizon indicator and the course bar on the course indicator centered as shown in A, figure 23.

b. Crossing Vor Station (B, fig. 23).

(1) When approaching the vor station, use the COURSE knob on the course indicator to set the course arrow to the desired outbound course.

(2) Slightly before the aircraft crosses the vor station, use the HEADING knob on the course indicator to align the heading marker with the course arrow. In B, figure 23, the course indicator shows that an outbound heading of 190° has been selected and the bank pointer on the approach horizon indicator shows that the aircraft is making a 30° left bank into the outbound heading.

(3) Turn the aircraft to keep the steering pointer on the approach horizon indicator centered.

c. Outbound From Vor Station (C, fig. 23).

(1) As the aircraft is established on the outbound course, use the HEADING knob on the course indicator to keep the course bar centered by making minor adjustments in the heading marker setting. This compensates for crosswind.

(2) Fly the aircraft to keep the steering pointer on the approach horizon indicator and the course bar on the course indicator centered as shown in C, figure 23.

d. Approaching Checkpoint (D, fig. 23).

(1) Leave the heading marker on the course indicator set on the course being flown.

(2) Tune the vor receiver to a checkpoint vor channel; use the COURSE knob on the course indicator to set the course arrow to the checkpoint radial.

(3) As the aircraft approaches the checkpoint, the course bar will approach the miniature airplane on the course indicator. When the course bar passes under the miniature airplane, the aircraft is over the checkpoint. In D, figure 23, the course arrow is shown set at a 280° checkpoint radial and the course bar is centered, indicating that the aircraft is just crossing the radial. The to-from arrow is pointing toward the checkpoint vor station.

e. Taking Bearing on Second Vor Station (E, fig. 23).

(1) Leave the heading marker on the course indicator set on the course being flown.

(2) Tune the vor receiver to the second vor station; use the COURSE knob on the course indicator to turn the course arrow until the course bar centers as shown in E, figure 23.

(3) When the course bar is centered, the to-from arrow points toward the vor station and the course arrow will show the bearing to and from the vor station at that instant. In E, figure 23, the course arrow shows that the momentary bearing to the vor station is due West (270°).

34. Vor Approach

To perform vor approach, follow the procedures below.

a. Transition (A, fig. 17).

(1) The procedure used to approach the vor station, to cross it, and to take the out-

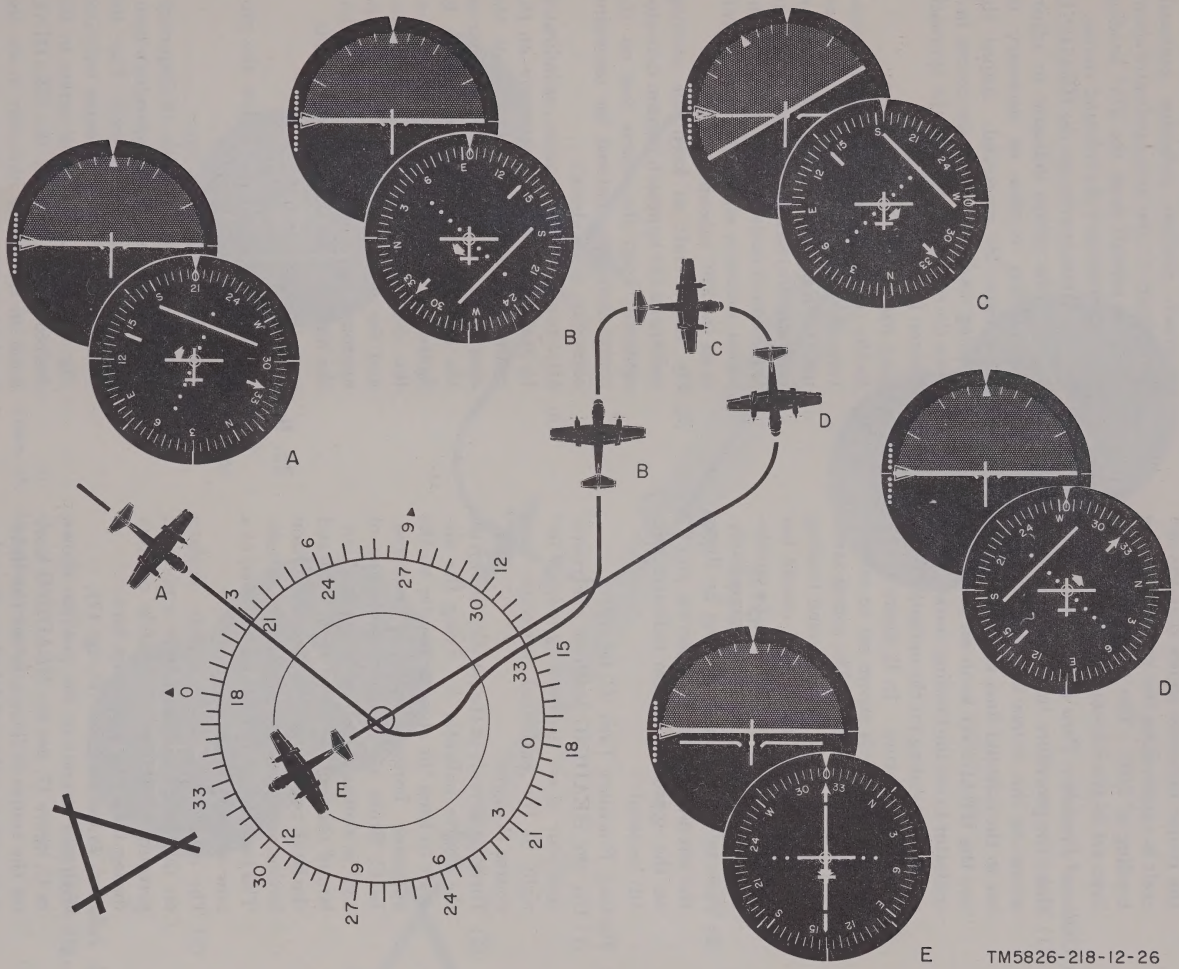


Figure 17. Vor approach.

bound course is covered in vor navigation procedures (par. 33*a*, *b*, and *c*).

(2) The outbound course will be the published outbound procedure radial for the particular vor station used. In A, figure 17, the course indicator shows that the aircraft is approaching the vor station on a heading of 210°. The course arrow has been set to the inbound heading of 320°.

b. Outbound Procedure Turn (B, fig. 17).

(1) Make the procedure turn with the course arrow on the course indicator (fig. 11) set to the inbound final approach radial; use the HEADING knob on the course indicator to set the heading marker to the published heading for the outbound leg of the procedure turn. In B, figure 17, the heading marker is shown set to an outbound heading of 95°. The course arrow remains set at the 320° inbound heading and the to-from arrow and course bar show the relative directions to the vor station and inbound heading respectively.

(2) Turn to the outbound heading by flying the aircraft to keep the steering pointer on the approach horizon indicator (fig. 10) centered.

c. Turning, Procedure Turn (C, fig. 17).

(1) Use the HEADING knob on the course indicator to set the heading marker 90° right of the outbound procedure turn course (*b* above).

(2) Turn the aircraft to the position shown on the course indicator by flying the aircraft to keep the steering pointer on the approach horizon indicator centered. In C, figure 17, an aircraft heading of 185° is shown (which is 90° right of outbound heading shown in B, fig. 17) and the bank pointer on the approach horizon indicator shows a 30° right bank attitude. The heading marker has been moved to a new setting (*d* below).

(3) The course bar and miniature airplane on the course indicator give a pictorial presentation of the aircraft's position during the entire procedure turn.

d. Inbound, Procedure Turn (D, fig. 17).

(1) With the aircraft in the position shown in C, figure 17, use the HEADING knob on the course indicator to set the heading marker to the published heading that will intersect the inbound course. In C, figure 17, the heading marker is shown set at a 275° heading.

(2) Turn to the heading by flying the aircraft to keep the steering pointer on the approach horizon indicator centered. In D, figure 17, the course indicator shows that the aircraft is on the 275° heading that will intersect the inbound course.

(3) During all maneuvers, use the HEADING knob on the course indicator to adjust the heading marker as necessary to compensate for crosswind. Adjust the heading marker to center the course bar; keep the steering pointer on the approach horizon indicator centered.

e. Inbound, Final Approach (E, fig. 17).

(1) As the course bar approaches the miniature airplane on the course indicator, use the HEADING knob on the course indicator to reset the heading marker to the inbound radial. In E, figure 17, the course indicator shows that the aircraft is on the 320° inbound heading.

(2) Fly the aircraft to keep the steering pointer on the approach horizon indicator centered; keep the course bar on the course indicator centered for crosswind correction (*d*(3) above).

(3) After passing the vor station, as indicated by reversal of the to-from arrow on the course indicator, start descent of the aircraft by reference to the pitch bar on the approach horizon indicator. In E, figure 17, the to-from arrow shows that the aircraft has passed the vor station and the pitch bar displacement on the approach horizon indicator shows that the aircraft is in a nosedown attitude.

35. Ils Holding Pattern

To fly an ils holding pattern, follow the procedures below.

a. Outer Marker Turn (A, fig. 18).

(1) Tune the vor receiver to the ils frequency. (Refer to the applicable operator's manual for tuning procedure.) Use the COURSE knob on the course indicator (fig. 11) to set the course arrow to the desired course, and use the HEADING knob on the course indicator to set the heading marker. Set both, the course

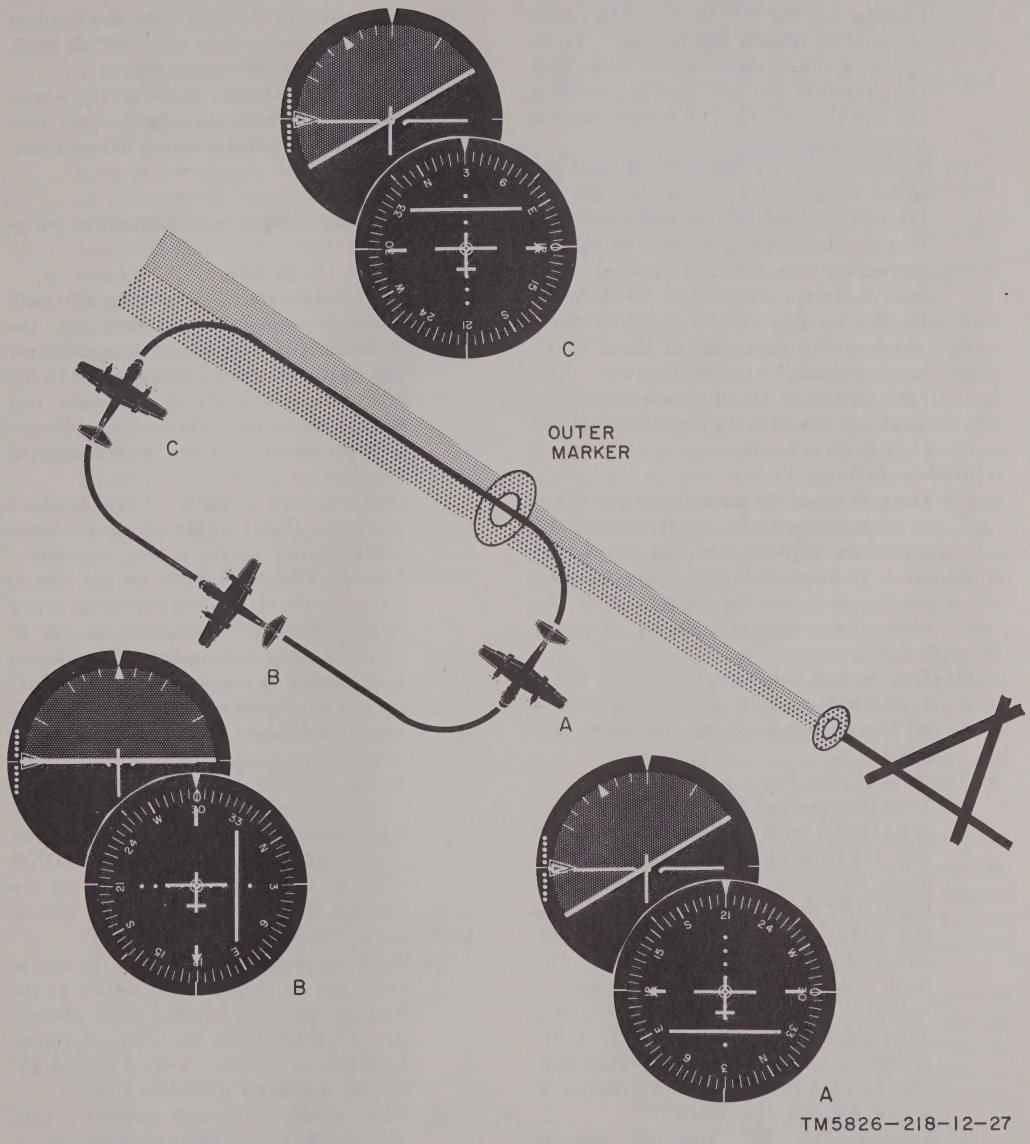


Figure 18. Ils holding pattern.

arrow and heading marker, to the published ils heading and adjust for drift due to crosswind (par. 34*d*(3)).

(2) At the outer marker, use the HEADING knob on the course indicator to move the heading marker 90° to the right; turn the aircraft toward this heading. In A, figure 18, the course indicator shows that the aircraft is on a 210° heading, which is 90° right of the 120° ils heading shown by the course arrow.

(3) Approximately 20° from the aircraft position shown in A, figure 18, use the HEADING knob on the course indicator to turn the heading marker to the reciprocal of the inbound heading (180° from the inbound heading). In A, figure 18, the heading marker is set at 300°, which is the reciprocal of the 120° ils heading shown by the course arrow. The bank pointer on the approach horizon indicator shows that the aircraft is in a 30° right bank attitude.

b. Outbound (B, fig. 18).

(1) The position of the aircraft relative to the ils beam is shown by the relation of the miniature airplane and the course bar on the course indicator. The heading marker indicates the reciprocal of the inbound heading (*a*(3) above), corrected for drift.

(2) Turn to and hold this heading by flying the aircraft to keep the steering pointer on the approach horizon indicator centered.

c. Turnback (C, fig. 18).

(1) After the specified time interval, use the HEADING knob on the course indicator (fig. 11) to advance the heading marker about 90° right; turn toward this heading and fly the aircraft to keep the steering pointer on the approach horizon indicator centered. In C, figure 18, the bank pointer on the approach horizon indicator shows that the aircraft is in a 30° right bank and coming on to a 30° course as indicated by the lubber line. The heading marker is shown moved to a new position ((2) below).

(2) Approximately 20° from the aircraft position shown in C, figure 18, use the HEADING knob on the course indicator to set the heading marker to the published inbound ils heading; make adjustments for drift due to crosswind (par. 34*d*(2)), and continue to hold this course. Fly the aircraft to keep the steering pointer on the approach horizon indicator centered. In C, figure 18, the heading marker is shown set to the 120° ils heading shown by the course arrow.

(3) Use the HEADING knob on the course indicator to make any slight corrections necessary to keep the course bar centered.

36. Ils Approach

To perform an ils approach, follow the procedure below.

a. Transition (A, fig. 24).

(1) Fly the aircraft on a heading that will intersect the outer marker; use the HEADING knob on the course indicator (fig. 11) to set the heading marker to the selected course. Keep the steering pointer on the approach horizon indicator (fig. 10) centered to stay on the selected course.

(2) Tune the vor receiver to the localizer channel. (Refer to the applicable operator's manual for the tuning procedure.) Use the COURSE knob on the course indicator (fig. 11) to set the course arrow to the published inbound course. In A, figure 24, the course indicator shows that the aircraft is approaching the outer marker on a heading of 210°. The course arrow has been set to the inbound heading of 320°.

(3) As the aircraft approaches the localizer beam, the course bar will approach the miniature airplane on the course indicator. At the outer marker, use the HEADING knob on the course indicator to set the heading marker at the outbound course.

b. Outbound, Procedure Turn (B, fig. 24).

(1) Make the procedure turn with the course arrow on the course indicator set at the localizer inbound heading (*a*(2) above); use the HEADING knob on the course indicator to turn the heading marker 45° left for outbound procedure turn.

(2) Turn to this outbound procedure turn heading; fly the aircraft to keep the steering pointer on the approach horizon indicator centered. In B, figure 24, the course indicator shows that the aircraft is

on a 95° outbound heading and the glide slope pointer on the approach horizon indicator shows that the aircraft is below the glidepath.

c. Turning, Procedure Turn (C, fig. 24).

(1) Use the HEADING knob on the course indicator to set the heading marker 90° right of the outbound procedure turn course. In C, figure 24, the bank pointer, on the approach horizon indicator shows that the aircraft is in a 30° right bank and is coming onto a 180° heading as indicated by the lubber line on the course indicator. The heading marker has been moved to a new position ((2) below).

(2) Fly the aircraft to center the steering pointer on the approach horizon indicator; after rolling into the turn, use the HEADING knob on the course indicator to reset the heading marker to the published heading that will intersect the inbound course. In C, figure 24, the heading marker is shown set to a heading of 275°.

Note. The course bar and miniature airplane on the course indicator give a pictorial presentation of the aircraft position during the entire procedure turn.

d. Inbound, Procedure Turn (D, fig. 24).

(1) As the course bar approaches the miniature airplane on the course indicator, use the HEADING knob on the course indicator to reset the heading marker to the published inbound ils course.

(2) Make minor corrections to center the course bar; use the HEADING knob on the course indicator to move the heading marker as required and, at the same time, fly the aircraft to keep the steering pointer on the approach horizon indicator centered. In D, figure 24, the course indicator lubber line shows that the aircraft is on a heading of 275°, which will intersect the inbound course.

e. Inbound, To Outer Marker (E, fig. 24).

(1) With the aircraft inbound on the localizer beam, and before crossing the outer marker, check to see that the GS and LOC flags on the approach horizon indicator (fig. 10) are masked (out of sight) and that the glide slope pointer is above center on the left side scale. In E, figure 24, the course arrow, course bar, and heading marker are shown aligned with the lubber line on a heading of 320° and the aircraft is on the ils inbound heading. The glide slope pointer on the approach horizon indicator shows that the aircraft is slightly above the glidepath.

(2) For ils final approach and go-around procedures, refer to paragraph 37.

37. Ils Final Approach and Go-Around

To perform ils final approach and go-around, follow the procedures below.

a. Approaching Outer Marker (A, fig. 19).

Note. In an ils approach, both modes of operation (hdg and ils) are used.

(1) To align the aircraft with the localizer beam at a point outside the outer marker, set the HDG-ILS switch on the approach horizon indicator (fig. 10) to HDG and follow the ils approach procedure (par. 36).

(2) With the aircraft inbound on the localizer beam, and before crossing the outer marker, check to see that the GS and LOC flags on the approach horizon indicator are masked (out of sight) and that the glide slope pointer is above center on the left side scale as shown in A, figure 19.

(3) When aligned with the localizer beam, set the HDG-ILS switch on the approach horizon indicator to ILS. Alignment with the localizer beam is indicated in A, figure 19, by the alignment of the course bar, course arrow, heading marker, and lubber line on the course indicator.

b. Final Approach (B, fig. 19).

(1) Adjust the power setting, or the pitch attitude of the aircraft, to keep the pitch bar and glide slope pointer aligned at center scale on the approach horizon indicator, as indicated, to follow the glide slope beam to breakout.

(2) Keep the steering pointer on the approach horizon indicator centered to provide automatic correction for drift due to crosswind. Crab angle is shown as displacement of the course arrow head from lubber line on the course indicator (not shown in B, fig. 19) and is the aircraft's true relation to the runway prior to breakout.

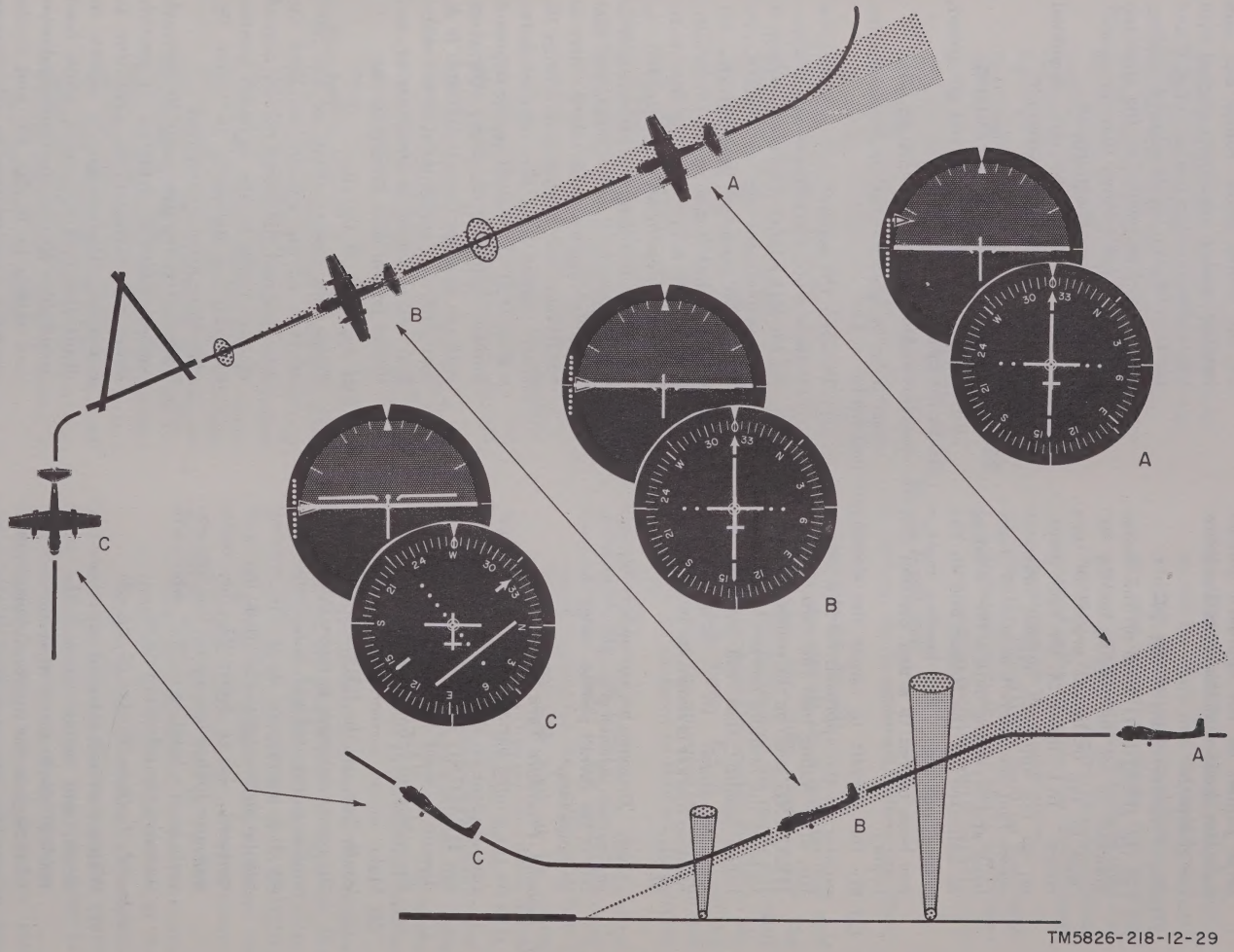


Figure 19. Ils final approach and go-around.

c. Landing or Go-Around (C, fig. 19).

(1) At breakout, landing is accomplished normally for the aircraft concerned. If a go-around is necessary, immediately set the HDG-ILS switch on the approach horizon indicator to HDG and follow the procedures for climbout and navigation (par. 30). If there is a published go-around heading, use the HEADING knob on the course indicator to set the heading marker to that heading, and keep the steering pointer on the approach horizon indicator centered.

(2) Reset the pitch TRIM knob on the approach horizon indicator for climbout configuration, if desired. In C, figure 19, the pitch bar on the approach horizon indicator shows that the aircraft has a noseup attitude. The course indicator shows that the aircraft has turned to a heading of 270° (west).

38. Ils Back Course

To perform an ils back course approach, follow the procedures below.

a. Course Alinement (A, fig. 20).

Note. The flight system course indicator (fig. 11) and approach horizon indicator (fig. 10) give a true picture of the aircraft in relation to the course at all times.

(1) Use the COURSE knob on the course indicator to set the head of the course arrow to the inbound localizer course (shown set at 270° in A, fig. 20).

(2) Use the HEADING knob on the course indicator to set the heading marker on a heading that will intercept the localizer course (shown set at 40° in A, fig. 20).

(3) Fly the aircraft to keep the steering pointer on the approach horizon indicator centered.

(4) When the course bar on the course indicator starts to move toward center, use the HEADING knob on the course indicator to reset the heading marker at the *tail* of the course arrow.

b. Final Approach (B, fig. 20).

(1) As the course bar on the course indicator centers, indicating that the aircraft is on the ils back course, the heading marker and *tail* of the course arrow on the course indicator should be aligned with the lubber line as shown in B, figure 20. Leave the HDG-ILS switch on the approach horizon indicator set to HDG. The pitch bar on the approach horizon indicator (B, fig. 20) shows a nosedown attitude.

(2) Observe the wind drift indication by the amount of deviation of the course bar from alinement with the course arrow on the course indicator (not shown in B, fig. 20). To eliminate course deviation caused by wind drift, use the HEADING knob on the course indicator to reset the heading marker, to aline the course bar with the course arrow; fly the aircraft to keep the steering pointer on the approach horizon indicator (fig. 10) centered.

(3) Disregard the glide slope pointer indications on the approach horizon indicator (fig. 10).

39. Radar Approach

To perform a radar approach, follow the procedures below.

a. Airport Surveillance Radar and Ground-Controlled Approach (A, fig. 21).

(1) Use the COURSE knob on the course indicator (fig. 11) to set the point head of the course arrow to the bearing of the runway to be used (shown set at 270° in A, fig. 21).

(2) Tune the vor receiver to the localizer channel. (Refer to the applicable operator's manual for tuning procedure.) If the localizer signal is present, operation of the course bar on the course indicator will be the same as described in the ils approach procedures (par. 36).

(3) If the localizer signal or other navigational signals are not present, the course bar on the course indicator will remain centered, but the heading of the aircraft with relation to the runway will be indicated by the position of the miniature airplane over the course bar.

b. Maneuvering (B, fig. 21).

(1) Control the aircraft to comply with the instructions from the ground controller; use the HEADING knob on the course indicator to set the heading marker and fly the aircraft to keep the steering pointer on the approach horizon indicator (fig. 10) centered.

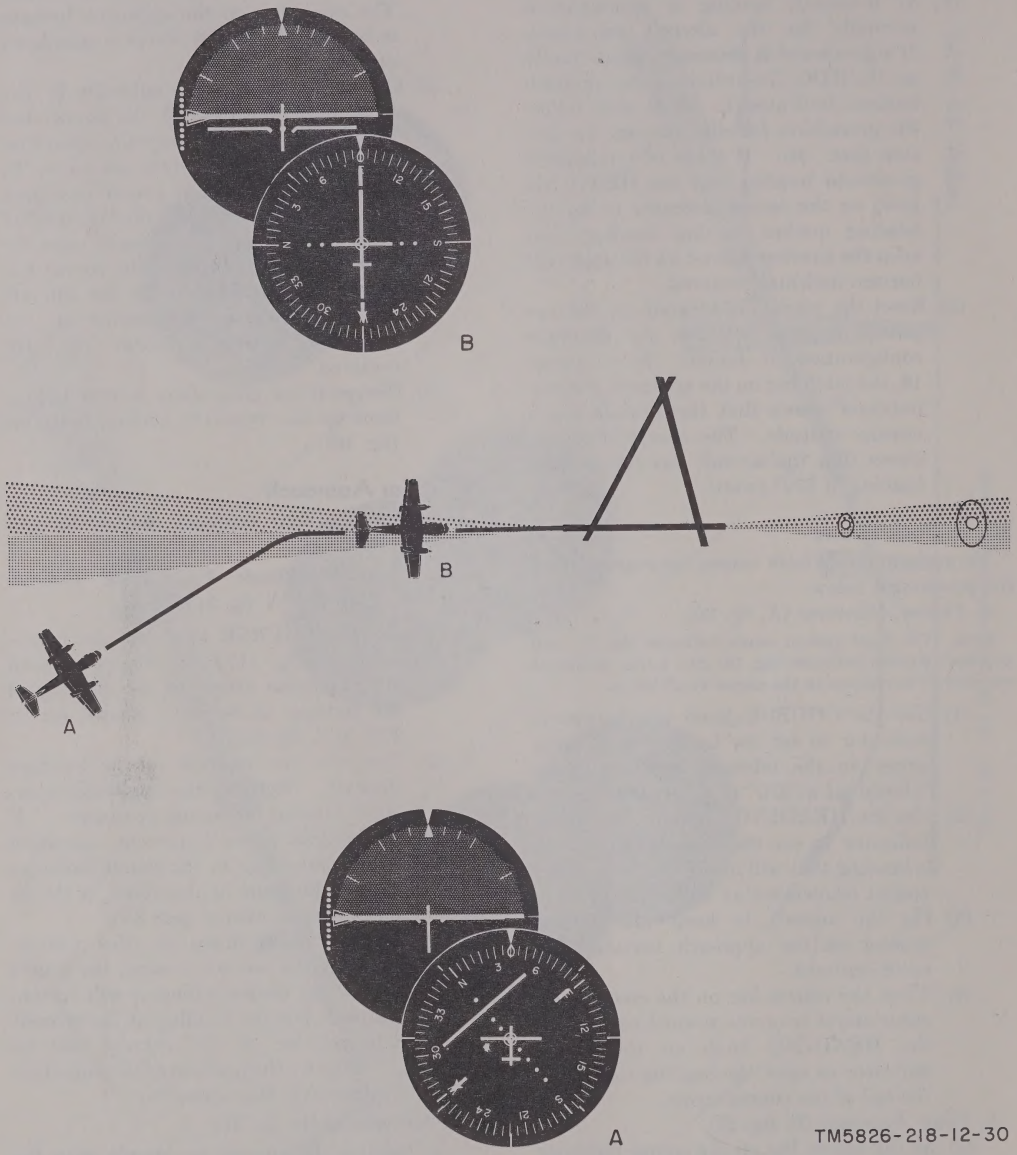


Figure 20. Ils back course.

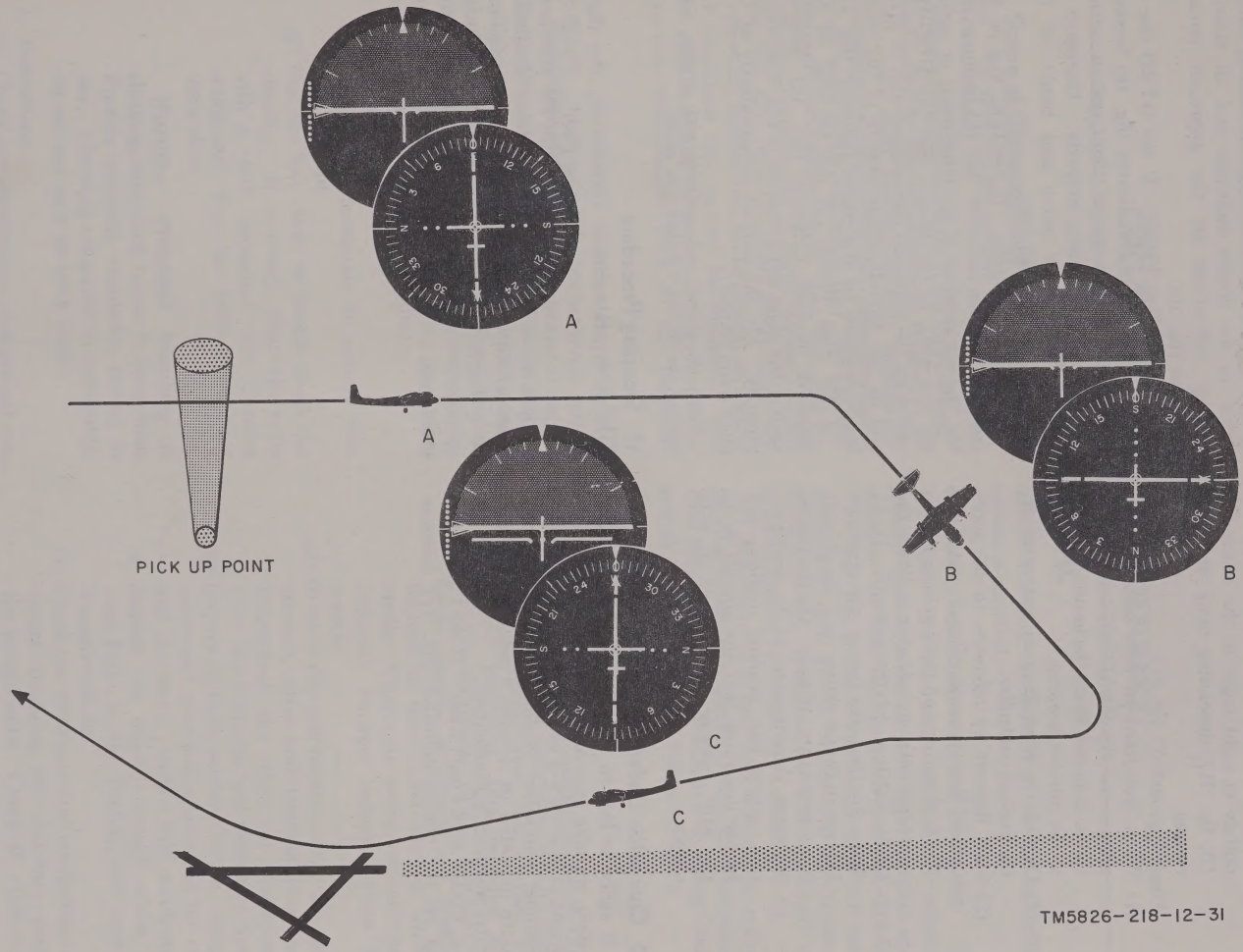


Figure 21. Radar approach.

(2) On the base leg, the miniature airplane on the course indicator will be approximately at right angle to the course bar (B, fig. 21), depending upon drift correction.

c. Final Approach (C, fig. 21).

(1) When instructed to turn into final approach, use the HEADING knob on the course indicator to set the heading marker to the runway heading.

(2) Correct for wind drift as instructed by the ground controller.

(3) Start descent by reference to the pitch bar on the approach horizon indicator. The horizon bar and bank pointer on the approach horizon indicator indicate the lateral attitude of the aircraft. In C, figure 21, the pitch bar on the approach horizon indicator shows that the aircraft has a nosedown attitude. On the course indicator, the alignment of the course arrow, course bar, heading marker, and lubber line show that the aircraft is on the 270° runway heading set in *a*(1) above.

40. Operation Under Unusual Conditions

If signal is lost to a component of the flight system, warning flags on the course and approach horizon indicators will indicate that signal loss by becoming unmasked (visible). Follow the procedure indicated (*a* through *e* below) for a particular warning flag indication.

a. COMPASS Flag Visible. If the COMPASS flag on the course indicator (fig. 11) becomes visible, the compass system is not functioning properly. Disregard all magnetic heading indications on the course indicator and all steering pointer indications on the approach horizon indicator (fig. 10).

b. GYRO Flag Visible. If the GYRO flag on the approach horizon indicator (fig. 10) becomes visible, the attitude system (flight system vertical gyro) is not functioning properly. Disregard all attitude indications (pitch and bank) on the approach horizon indicator.

c. LOC Flag Visible. If the LOC flag on the approach horizon indicator (fig. 10) becomes visible, the vor receiver is not functioning or signals are too weak to be usable. Set the HDG-ILS switch on the approach horizon indicator to HDG and fly the aircraft independently of the course bar indications on the course indicator (fig. 11).

d. GS Flag Visible. If the GS flag on the approach horizon indicator (fig. 10) becomes visible, the glide slope receiver is not functioning properly. Fly the aircraft independently of the glide slope pointer.

Note. On aircraft not equipped with a glide slope receiver, the GS flag will always be visible.

41. Stopping Procedure

In a typical aircraft installation, the flight system is not turned off during flight. The flight system is turned off, together with the associated equipment, when all signal electronic equipment power circuit breakers are deenergized at the end of a flight. Refer to the applicable aircraft operator's manual for complete stopping procedure.

CHAPTER 3
ORGANIZATIONAL MAINTENANCE

Section I. GENERAL

42. Scope of Organizational Maintenance

Note. The pilot will not perform preventive or corrective maintenance.

Organizational maintenance of the flight system, as performed by the organizational repairman or aircraft crew chief (second echelon) consists of preventive maintenance (par. 44), corrective maintenance using visual inspection (par. 45) and the equipment performance check (par. 46), and removal and replacement of flight system components (par. 47). Use DA Form 2391–2 (par. 2*c*) to report all deficiencies, malfunctions, or abnormal conditions that cannot be remedied. For more specific details for performing preventive or corrective maintenance, refer to the technical manual covering the aircraft in which the flight system is installed.

43. Tools, Test Equipment, and Materials

a. Tools. All the tools required for second echelon maintenance on the flight system are contained in Tool Kit, Radio Repair TK–115/G.

b. Test Equipment. The only item of test equipment that will be required is Multimeter AN/URM–105 (multimeter). For operation of the multimeter, refer to TM 11–6625–203–12.

c. Materials. The materials required for maintenance consist of a cleaning cloth, fine sandpaper (No. 000), a soft-bristle brush, and Cleaning Compound (Federal stock No. 7930–395–9542).

Section II. MAINTENANCE PROCEDURES

44. Preventive Maintenance

Preventive maintenance is work performed on the flight system to keep it in good working order and minimize breakdowns and needless interruptions in service. The organizational maintenance repairman should perform the following preventive maintenance at the intervals specified.

a. Techniques.

(1) Use the fine sandpaper to remove rust and corrosion.

(2) Use the soft cloth or bristle brush for cleaning. If necessary, clean the parts with a cloth moistened with cleaning compound; wipe the parts dry with a clean cloth.

> ***Warning:*** **Prolonged breathing of cleaning compound fumes is dangerous. Provide adequate ventilation during its use. Cleaning compound is flammable; do not use near an open flame.**

b. Instructions.

(1) Check for completeness and general condition of the steering computer, instrument amplifier, course indicator, approach horizon indicator, sensor, flight system vertical gyro, vor coupler, vor coupler mounting, and computer and amplifier mounting. Make sure that no knobs, screws, or clamps are missing. Replace all missing hardware or broken knobs. Check the course indicator and approach horizon indicator faces for cracks.

(2) Remove dirt and moisture from the components, cables, and electrical connectors. Disconnect the electrical connectors, clean the contacts, and reconnect them.

(3) Inspect all metal surfaces on the components and electrical connectors for rust and corrosion; remove with sandpaper.

(4) Inspect the interconnecting cables for cuts, kinks, breaks, fraying, and signs of excessive strain.

(5) Check the shock-mounted components for secure mounting and clearance around the components. Check all other components for secure mounting.

(6) Check all accessible items (knobs, screw, nuts, etc) to make sure they are properly tightened. Tighten any loose item.

(7) Check the COURSE and HEADING knobs on the course indicator for easy operation; check the TRIM knob and HDG-ILS switch on the approach horizon indicator for easy operation.

(8) Check for normal operation of the flight system; be alert for any unusual operating conditions. Refer to the equipment performance check (par. 46).

45. Visual Inspection

a. When the flight system fails to perform properly during the pilot's preflight operational check (par. 27*b*), or during flight procedures performed by the pilot, check for the following:

(1) Wrong setting of switches and controls on the vor receiver control panel, magnetic compass system control panel, glide slope receiver controls (refer to the applicable operator's manual on these equipments for switch and control settings), course indicator, and approach horizon indicator.

(2) Disconnected or poorly connected cable connections between all components of the flight system and the associated vor receiver, glide slope receiver, and magnetic compass system.

(3) Defective cables and electrical connectors (broken pins and wires).

(4) Tripped circuit breakers on the aircraft's circuit breaker panel. (Refer to the applicable aircraft manual for circuit breakers associated with the flight system power distribution.)

b. If the above checks do not locate the trouble, proceed to the equipment performance checklist (par. 46).

46. Equipment Performance Checklist

The equipment performance checklist is a systematic troubleshooting procedure to isolate trouble to a component of the flight system, or to a component of the associated equipment, with a minimum of effort and time. Perform the visual inspection (par. 45); then, operate the equipment as directed in the equipment performance checklist and look for the normal indications listed. If an abnormal indication is observed, follow the corrective measure outlined in the final column of the checklist and follow each step in order. If the corrective measures indicated do not repair the equipment, troubleshooting is required by higher echelon. Note on the repair tag how the equipment performed and what corrective measures were taken.

Note. Where the equipment performance checklist indicates a need to troubleshoot or replace the vor receiver, glide slope receiver, or magnetic compass system components, refer to the applicable technical manual for that equipment for organizational maintenance procedures.

	Step	Unit	Action	Normal indication	Corrective measure
PRELIMINARY	1	All	Perform visual inspection (par 45).		
START	2	Vor receiver, magnetic compass system, glide slope receiver, flight system.	Energize. Refer to applicable aircraft technical manual for proper starting procedure, control settings, and indications.	Approach horizon and course indicators bezel lights illuminate. Flight system vertical gyro is energized (may be heard running).	Troubleshoot aircraft electrical system. Refer to applicable aircraft manual for power distribution and circuit breaker troubleshooting procedure.
	3	Vor receiver control panel.	Set for omnirange operation.		
		Magnetic compass system controls.	Set for slaved operation.		
		Glide slope receiver control.	Turn on.		
		Approach horizon indicator HDG–ILS switch (fig. 10).	Set to HDG.		

Step	Unit	Action	Normal indication	Corrective measure
4	GYRO and STEERING flags on approach horizon indicator (fig. 10), and COMPASS flag on course indicator (fig. 11).	Observe	Masked (not visible)	Replace steering computer and instrument amplifier (par. 47). Troubleshoot magnetic compass system. Use multimeter to check flight system vertical gyro as follows: Turn off power and disconnect electrical power connector from flight system vertical gyro. Check for low resistance between pins B and A at the gyroscope connector; if infinite, replace flight system vertical gyro (par. 47). If resistance is low, reconnect connector. Replace sensor (par. 47). Replace approach horizon indicator (par. 47). Refer to higher echelon.
5	HEADING knob on course indicator (fig. 11).	Move heading marker 90° and return to lubber line.	Steering pointer on approach horizon indicator (fig. 10) deflects in a corresponding direction, then returns to center.	Replace steering computer (par. 47). Replace approach horizon indicator (par. 47). Replace course indicator (par. 47). Refer to higher echelon.
6	HDG-ILS switch on approach horizon indicator (fig. 10).	Set to ILS. Use HEADING knob on course indicator (fig. 11) and move course arrow 5° and return quickly to lubber line. Return HDG-ILS switch to HDG.	Steering pointer on approach horizon indicator (fig. 10) deflects abruptly and returns to center slowly.	Replace steering computer (par. 47). Replace approach horizon indicator (par. 47). Replace course indicator (par 47). Refer to higher echelon.
7	Vor receiver control panel.	Tune to vor station if available. (Refer to applicable operator's manual for procedure.)	LOC flag on approach horizon indicator (fig. 10) is masked.	Replace vor receiver. Replace approach horizon indicator (par. 47). Refer to higher echelon.
8	Vor receiver control panel.	Tune to localizer channel if available. (Refer to applicable operator's manual for procedure.)	Same as 7 above.	Same as 7 above.
9	Vor receiver control panel.	Retune to vor station.		
	COURSE knob on course indicator (fig. 11).	Set course arrow on course indicator to vor radial that aligns with aircraft.	Course bar on course indicator centers; to-from arrow points toward vor station.	Replace vor receiver. Replace course indicator (par. 47). Replace vor coupler (par. 47). Refer to higher echelon.
10	Glide slope receiver control.	Tune to glide slope channel if available. (Refer to applicable operator's manual for tuning procedure.)		
	HDG-ILS switch on approach horizon indicator (fig. 10).	Set to ILS	Glide slope pointer on approach horizon indicator deflects; GS flag is masked.	Replace glide slope receiver. Replace approach horizon indicator (par. 47). Refer to higher echelon.

Step	Unit	Action	Normal indication	Corrective measure
11	HDG-ILS switch on approach horizon indicator.	Set to HDG	Azmiuth ring on course indicator should indicate same magnetic heading (±3°) as aircraft's radio magnetic indicator.	Troubleshoot magnetic compass system. Replace instrument amplifier (par. 47). Replace course indicator (par 47). Refer to higher echelon.
12	Heading select switch on magnetic compass system control panel.	Set to L and then to R. (Refer to applicable operator's manual for location and operation.)	Magnetic compass system compass gyro should rotate 360° and the azimuth ring on course indicator should follow rotation.	Troubleshoot magnetic compass system. Replace instrument amplifier (par. 47). Replace course indicator (par. 47). Refer to higher echelon.
13	Flight system vertical gyro. (Refer to applicable aircraft manual for location.)	Temporarily remove mounting hardware that fastens unit to equipment shelf. Station another person to observe approach horizon indicator on aircraft instrument panel.		
		Position flight system vertical gyro for noseup, then nosedown attitude.	Pitch bar on approach horizon indicator (fig. 10) should indicate noseup, then nosedown attitude.	
		Position flight system vertical gyro for left bank, then a right bank attitude. Use hardware removed, and fasten flight system vertical gyro to its normal mounting position.	Horizon disk on approach horizon indicator indicates left bank, then right bank attitude.	Turn off power and use multimeter to check flight system vertical gyro and sensor as follows: Disconnect cable connectors from the two units. On sensor at J2302, check for following resistance indications: K–J and U–V, 0 ohm. L–H, infinite. D–H, low resistance. On flight system vertical gyro at J1, check for following resistance indications: K–L, M–L, E–J, E–N, J–N, H–F, H–T, and F–T; all should indicate low resistance reading. If resistance checks on either unit are different from that indicated, replace that unit; otherwise, reconnect cable connectors. Replace approach horizon indicator (par 47). Replace instrument amplifier (par 47). Refer to higher echelon.

	Step	Unit	Action	Normal indication	
STOP	14	All	Turn off all equipment power. (Refer to applicable aircraft manual for stopping procedure.)		

47. Removal and Replacement of Flight System Components

Note. These are *general* procedures for the removal and replacement of the flight system components. For *detailed* procedures and the location of the components in a particular aircraft, refer to the applicable aircraft technical manual.

a. Removal of Instrument Amplifier (fig. 3).

(1) Remove the lockwire from the thumbscrew at the front of the instrument amplifier panel.

(2) Loosen the thumbscrew.

(3) Pull the instrument amplifier forward to disengage the two electrical connectors at the rear of the unit (not shown).

(4) Remove the instrument amplifier from the computer and amplifier mounting.

b. Replacement of Instrument Amplifier (fig. 3).

(1) Align the instrument amplifier with the guide pins at the electrical connectors (not shown) on the computer and amplifier mounting.

(2) Carefully slide the instrument amplifier forward until the two electrical connectors at the rear are completely engaged.

(3) Tighten the thumbscrew.

(4) Install the lockwire to secure the thumbscrew.

c. Removal of Steering Computer (fig. 3). Removal procedure for the steering computer is identical with the removal procedure for the instrument amplifier (*a* above), except only one electrical connector disengagement is at the rear.

d. Replacement of Steering Computer (fig. 3). Replacement procedure for the steering computer is identical with the replacement procedure for the instrument amplifier (*b* above).

e. Removal of Computer and Amplifier Mounting (fig. 3).

(1) Remove the instrument amplifier and steering computer from the computer and amplifier mounting (a and c above).

(2) At the rear of the computer and amplifier mounting, open the cover inclosing the electrical receptacles (not shown) by removing the screws and lockwashers in the top of the cover.

(3) Remove the nuts, screws, and washers that secure the three electrical receptacles to the computer and amplifier mounting.

(4) Remove (withdraw) the three receptacles from the computer and amplifier mounting.

(5) Remove the nuts, washers, screws, and bonding strap connection that fasten the computer and amplifier mounting to the aircraft equipment mounting shelf.

(6) Remove the computer and amplifier mounting.

f. Replacement of Computer and Amplifier Mounting (fig. 3).

(1) Position the computer and amplifier mounting on the aircraft equipment mounting shelf.

(2) Install the screws, washers, and nuts, and make the bonding strap connection to fasten the computer and amplifier mounting to the mounting shelf.

(3) Position the three electrical receptacles at their proper locations and install the screws, washers, and nuts that secure the receptacles in the computer and amplifier mounting.

(4) Position the cover over the electrical connectors and install the screws and washers that secure the cover to the computer and amplifier mounting.

(5) Install the instrument amplifier and steering computer onto the computer and amplifier mounting (*b* and *d* above).

g. Removal of Course Indicator (fig. 4).

(1) Disconnect the two cable connectors (not shown) at the rear of the course indicator.

(2) Loosen the two screws, one at the upper right and one at the lower left, on the front of the mounting clamp that holds

the course indicator on the aircraft instrument panel.

(3) Slide the course indicator forward to remove it from the instrument panel.

h. Replacement of Course Indicator (fig. 4).

(1) Position the course indicator in the aircraft instrument panel.

(2) Tighten the two screws, one at upper right and one at lower left, on the front of the mounting clamp that holds the course indicator on the instrument panel.

(3) Connect the two cable connectors at the rear of the course indicator.

i. Removal of Approach Horizon Indicator (fig. 5). Removal procedure for the approach horizon indicator is identical with the removal procedure for the course indicator (*g* above).

j. Replacement of Approach Horizon Indicator (fig. 5). Replacement procedure for the approach horizon indicator is identical with the replacement procedure for the course indicator (*h* above).

k. Removal of Sensor (fig. 6).

(1) Disconnect the cable connector from J2302, the receptacle on the front (left side) of the sensor.

(2) Remove the screws and washers that fasten the sensor to the aircraft equipment mounting shelf.

(3) Remove the sensor from the equipment mounting shelf.

l. Replacement of Sensor (fig. 6).

(1) Position the sensor on the aircraft equipment mounting shelf.

(2) Install the screws and washers that fasten the sensor to the shelf.

(3) Connect the cable connector to J2302, the receptacle on the front (left side) of the sensor.

m. Removal of Flight System Vertical Gyro (fig. 7).

(1) Disconnect the cable connector from the electrical receptacle located near the base of the flight system vertical gyro.

(2) Remove the screws and washers that fasten the unit to the equipment mounting shelf.

(3) Remove the flight system vertical gyro from the equipment mounting shelf.

n. Replacement of Flight System Vertical Gyro (fig. 7).

(1) Position the flight system vertical gyro on the equipment mounting shelf.

(2) Install the screws and washers that fasten the flight system vertical gyro to the equipment mounting shelf.

(3) Connect the cable connector to the electrical receptacle located near the base of the unit.

o. Removal of Vor Coupler (fig. 8).

(1) Remove the lockwire from the two thumbscrews at the front of the vor coupler.

(2) Disconnect the cable connector from P1, the electrical receptacle on the front of the unit.

(3) Disengage the thumbscrews, pull the vor coupler forward, and remove the vor coupler from the vor coupler mounting.

p. Replacement of Vor Coupler (fig. 8).

(1) Position the vor coupler on the vor coupler mounting and slide the vor coupler to the rear of the mounting.

(2) Tighten the two thumbscrews on the front of the vor coupler.

(3) Connect the cable connector to P1, the electrical receptacle on the front of the unit.

(4) Install the lockwire to secure the two thumbscrews.

q. Removal of Vor Coupler Mounting (fig. 8).

(1) Remove the vor coupler from the vor coupler mounting (*o* above).

(2) Remove the nuts, washers, bonding strap connection, and screws that fasten the unit to the equipment mounting shelf.

(3) Remove the vor coupler mounting from the equipment mounting shelf.

r. Replacement of Vor Coupler Mounting (fig. 8).

(1) Position the vor coupler mounting on the equipment mounting shelf.

(2) Install the screws, washers, and nuts, and make the bonding strap connection to fasten the vor coupler mounting to the equipment mounting shelf.

(3) Install the vor coupler (*p* above).

CHAPTER 4

DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

48. Authority for Demolition

The demolition procedures in paragraph 49 will be used to prevent the enemy from using or salvaging any parts of the flight system. Demolition of the flight system will be accomplished only upon the order of the commander.

49. Methods of Destruction

Any or all of the methods of destruction below may be used. The time available will determine the destruction methods. Also, the tactical situation will determine how the destruction will be carried out. In most cases, it is preferable to demolish completely some portions of the flight system rather than partially destroy all the components.

a. Smash. Smash the flight system components; use sledges, axes, hammers, crowbars, and any other heavy tools available.

b. Cut. Cut the interconnecting cables and equipment internal cable harnesses; use axes, handaxes, machetes, and similar tools.

c. Burn. Burn as much of the equipment as is flammable; use gasoline, oil, flamethrowers, and similar flammables. Burn the instruction literature first. Pour gasoline on the cut cables and internal wiring and ignite it. Use a flamethrower to burn spare parts or pour gasoline on the spares and ignite them. Use incendiary grenades to complete the destruction of the flight system components.

Warning: **Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.**

d. Explode. Use explosives to complete demolition or to cause maximum damage, before burning, when time does not permit complete demolition by other means. Powder charges, fragmentation grenades, or incendiary grenades may be used. Incendiary grenades usually are most effective.

e. Dispose. Bury or scatter destroyed parts or throw them into nearby waterways. This is particularly important if a number of parts have not been completely destroyed.

APPENDIX I
REFERENCES

Following are applicable references available to the operator and organizational maintenance man:

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders
TM 1–225	Navigation for Army Aviation
TM 11–5826–200–12	Operator and Organizational Maintenance Manual; Receiver Group AN/ARA–54
TM 11–5826–207–10	Operator's Manual; Radio Receiving Sets AN/ARN–30A, AN/ARN–30B, and AN/ARN–30C
TM 11–5826–215–12	Operator and Organizational Maintenance Manual; Receiving Set, Radio AN/ARN–30D
TM 11–6615–214–15	Operators, Organizational, Field and Depot Maintenance; Navy Type MA–1 Compass (Lear)
TM 11–6625–203–12	Operation and Organizational Maintenance, Multimeter AN/URM–105, including Multimeter ME–77/U

814–026–4

APPENDIX II

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

1. General

a. This appendix assigns maintenance functions to be performed on components, assemblies, and subassemblies by the lowest appropriate maintenance echelon.

b. Columns in the MAC are as follows:

(1) *Part or Component.* This column shows only the nomenclature or standard item name. Additional descriptive data are included only where clarification is necessary to identify the component. Components, assemblies, and subassemblies are listed in top-down order. That is, the assemblies which are part of a component are listed immediately below that component, and the subassemblies which are part of an assembly are listed immediately below that assembly. Each generation breakdown (components, assemblies, or subassemblies) is listed in disassembly order or alphabetical order.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelons.

(*a*) *Service.* To clean, to preserve, and to replenish lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(*e*) *Replace.* To substitute serviceable components, assemblies, or subassemblies, for unserviceable components, assemblies, or subassemblies.

(*f*) *Repair.* To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

(*g*) *Aline.* To adjust two or more components of an electrical system so that their functions are properly synchronized.

(*h*) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(*i*) *Overhaul.* To restore an item to *completely serviceable* condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IORAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

(3) *2d, 3d, 4th, 5th echelon.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the

maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding columns.

c. Columns in the allocation of tools for maintenance functions are as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *2d, 3d, 4th, 5th echelon.* The dagger (†) indicates the echelons normally allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

2. Maintenance by Using Organizations

When this equipment is used by signal service organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

Section II. MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
COMPUTER SET, NAVIGATIONAL AN/ASN-33 AND COUPLER INDICATOR CU-865/ASN (FORMERLY: COLLINS TYPE FD-105 INTEGRATED FLIGHT SYSTEM)	service		X					Tool and test requirements
	adjust			X			4,6,18	Allocated to 5th echelon
	adjust				X		1,3,6,7,18	Can be used at 4th echelon
	inspect		X					
	test			X			3,6,7,12,22,23	
					X		3,6,7,10,11,13,14, 16,18,20,21,22	
						X	2,3,6,7,8,9,10,11, 12,13,14,15,16,18, 20,21,22	
	replace		X				17	
	repair			X			18,19	
	align			X			4,6,7,18	
	calibrate				X		1,3,4,6,7,10,11, 12,13,14,15,16, 20,21,22	
	overhaul					X		
AMPLIFIER ASSEMBLY AM-2853/ASN	service		X					
	inspect		X					
	test			X			6,7,13	
	replace		X				17	
	repair			X			18	
	align				X		6,7,13	
	overhaul				X			
BASE ROLLED	replace			X				
	repair				X			
CHASSIS, WIRING FRAME	replace			X				
	repair				X			
COVER	replace			X				
	repair				X			
FLAG AMPLIFIER	replace			X				
	repair				X			
	overhaul					X		
POWER SUPPLY ASSEMBLY	replace			X				
	overhaul					X		

Section II. MAINTENANCE ALLOCATION CHART—Continued

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/ASN-33; CU-865/ASN (continued)								
SERVO AMPLIFIER	replace			X				
	overhaul					X		
COMPUTER NAVIGATIONAL CP-583/ASN	service		X					
				X			6,18	
	inspect		X					
	test			X			6,7,12,14	
	replace		X				17	
	repair				X		18,19	
	align			X			6,7,12,14	
	overhaul					X		
AMPLIFIER, TYPE INCL PLUG: TYPE IV (MODULE)	replace			X				
	repair				X			
	overhaul					X		
CHASSIS ASSEMBLY	replace			X				
	repair				X			
	overhaul					X		
COMPUTER, MODULE ASSEMBLY	replace			X				
	repair				X			
	overhaul				X			
POWER SUPPLY ASSEMBLY	replace			X				
	repair				X			
	overhaul				X			
COUPLER, INDICATOR CU-865/ASN	service		X					
	inspect		X					
	test			X			6,7,22,23	
	replace		X				17	
	repair			X			18	
	overhaul				X			
BEARING MECHANISM ASSEMBLY MODULE A4	replace			X				
	repair				X			
	overhaul				X			
BEARING, SERVO AMPLIFIER, MODULE A3	replace			X				
	repair				X			
	overhaul				X			
CHASSIS ASSEMBLY	replace			X				
	repair				X			
	overhaul				X			

Section II. MAINTENANCE ALLOCATION CHART—Continued

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/ASN-33, CU-865/ASN (continued)								
CONVERTER, DISCRIMINATOR, MODULE A3	replace			X				
	repair				X			
	overhaul				X			
POWER RELAY, MODULE A1	replace			X				
	repair				X			
	overhaul				X			
GYROSCOPE, DISPLACEMENT CN-708/ASN	service		X					
	inspect		X					
	test		X				5	
	replace		X				17	
	repair				X			
	overhaul					X		
GYROSCOPE, RATE CN-709/ASN	service		X					
	inspect		X					
	test		X				5	
	replace		X				17	
	repair				X			
	overhaul					X		
RATE GYRO	replace					X		
	overhaul					X		
RELAY BOX	repair				X			
	overhaul				X			
INDICATOR, ATTITUDE NAVIGATION ID-882/ASN	service		X					
	inspect		X					
	test				X		3, 6, 7, 8, 15	
	replace		X				17	
	repair			X			18, 19	
	align				X		3, 6, 7	
	calibrate					X	6, 7, 9, 12, 15	
	overhaul					X		

Section II. MAINTENANCE ALLOCATION CHART—Continued

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/ASN-33, CU-865/ASN (continued)								
INDICATOR, COURSE ID-883/ASN	service		X					
	inspect		X					
	test				X		2,3,6,7,11,16	
	replace		X				17	
	repair				X			
	align				X		6,7,11,16	
	calibrate					X	6,7,8,9,11,16	
	overhaul					X		
MOUNTING MT-2417/ASN	service		X					
	inspect		X					
	replace		X				17	
	repair				X		18,19	
	overhaul				X			
MOUNTING MT-2416/ASN	service		X					
	inspect		X					
	replace		X				17	
	repair				X		18,19	
	overhaul				X			

Section III. ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH	(3) 2ND ECH	(4) 3RD ECH	(5) 4TH ECH	(6) 5TH ECH	(7) TOOL CODE	(8) REMARKS
AN/ASN-33, CU-865/ASN (continued)							
ADJUSTMENT TOOL, SYNCHRO TL-675/ASN-33				+	+	1	
AMMETER ME-221/ASN-33					+	2	
AMMETER ME-222/ASN-33			+	+	+	3	
GAUGE TL-558/U			+	+	+	4	
MULTIMETER AN/URM-105		+				5	
MULTIMETER TS-352/U			+	+	+	6	
MULTIMETER METER ME-26/U			+	+	+	7	
RESISTANCE BRIDGE ZM-4/U					+	8	
PANEL, TEST, SYNCHRO RESOLVER SB-1430/ASN-33					+	9	Collins Nr. 479-X2
SIMULATOR, GYROSCOPE SIGNAL SM-253/ASM-57				+	+	10	Collins Nr. 477K-1
SIMULATOR, NAVIGATIONAL CONTROL SM-254/ASM-57				+	+	11	Collins Nr. 477L-1
STOP WATCH FSN 6645-719-8670			+	+	+	12	
TEST SET, AMPLIFIER INDICATOR TS-1624/ASM-57					+	13	Collins Nr. 474M-1
TEST SET, COMPUTER TS-1625/ASM-57					+	14	Collins No. 477N-1
TEST SET, INDICATOR TS-1626/ASM-57					+	15	Collins Nr. 477P-1
TEST SET, INDICATOR TS-1627/ASM-57					+	16	Collins Nr. 477Q-1
TOOL KIT TK-115/G		+				17	
TOOL KIT TK-87/U			+	+	+	18	
TOOL KIT TK-88/U				+	+	19	
VOLTMETER, METER ME-30/U				+	+	20	
BENCH TEST HARNESS: Fabricate per Instruction Book FD-105, SP-102, SECTION II, Paragraph 2.2				+		21	
MAINTENANCE KIT MK-570( )/ARC: ELECT EQUIP			+	+	+	22	
SIGNAL GENERATOR SG/ARN-1				+	+	23	

APPENDIX III
BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. General

This appendix lists items supplied for initial operation. The list includes tools, parts, and material issued as *part of* the major end item. The list includes all items authorized for basic maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

2. Columns

a. Source, Maintenance, and Recoverability Code. Not used.

b. Federal Stock Number. This column lists the 11-digit Federal stock number.

c. Designation by Model. Not used.

d. Description. Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

e. Unit of Issue. The unit of issue is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes. Not used.

f. Expendability. Nonexpendable items are indicated by NX. Expendable items are not annotated.

g. Quantity Authorized. Under "Items Comprising an Operable Equipment," the column lists the quantity of items supplied for the initial operation of the equipment.

814-026-3

SECTION II FUNCTIONAL PARTS LIST

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO.	(9) ILLUSTRATIONS ITEM NO.
	5826-446-1409		COMPUTOR SET, NAVIGATIONAL AN/ASN-33 AND COUPLER INDICATOR CU-865/ASN: formerly Collins FD-105 Integrated Flight System, intelligence received, basic attitude, position and storing, intelligence transmitted course, heading and attitude		NX			
			ITEMS COMPRISING AN OPERABLE EQUIPMENT					
	6610-588-7306		CLAMP: Mounts ID-882/ASN also ID-883/ASN: Collins No. 545-2279-002			2		
	5826-486-8067		AMPLIFIER ASSEMBLY; AM-2853/ASN: formerly Instrument Amplifier, Collins type No. 344C-1; contains three "C" servo amplifiers for pitch and bank			1		
	5826-446-1407		COMPUTER, NAVIGATIONAL; CP-583/ASN: formerly Steering Computor, Collins type No. 562A-5; supplies signals to pointer of ID-882/ASN		NX	1		
	5826-446-1406		COUPLER, INDICATOR; CU-865/ASN: formerly Instrumentation coupler; Collins type No. 161C-1; 9480 to 10,440 cps freq range; 115 v, 380-420 cps single ph			2		
	6615-486-8072		GYROSCOPE, DISPLACEMENT; CN-708/ASN: formerly; Cageable, Vertical Gyro; Collins type No. 332D-8; 26 v, 400 cps; indicates pitch and roll		NX	1		
	6615-486-8073		GYROSCOPE, RATE; CN-709/ASN: formerly Sensing Unit; Collins type No. 345A2; 115 vrms, 400 cps ac; 27.5 v dc			1		
	5826-445-8311		INDICATOR, ATTITUDE NAVIGATION; ID-882/ASN: formerly Approach Horizon; Collins type 329B-4A; 26 v, 400 cps, 3 wire oper pw			1		
	5826-446-1408		INDICATOR, COURSE; ID-883/ASN: formerly Course Indicator; Collins type No. 331A-4 26 v, 400 cps		NX	1		
	5826-445-8312		MOUNTING; MT-2417/ASN: formerly Shockmount; Collins type No. 390F-5; mounts Coupler indicator CU-865/ASN		NX	2		
	5826-445-8310		MOUNTING MT-2416/ASN: formerly Shockmount, Collins type No. 390-5; mounts AM-2853/ASN and CP-583/ASN components		NX	1		
			RUNNING SPARES AND ACCESSORY ITEMS					
			NO PARTS AUTHORIZED FOR STOCKAGE AT FIRST ECHELON.					

GLOSSARY

Section I. ABBREVIATIONS

Hdg Heading
Ils Instrument landing system
Var Visual-aural vhf (very high-frequency) radio range
Vor Vhf omnidirectional range

Section II. DEFINITION OF TERMS

Attitude—The position of an aircraft, considering the inclination of its axes in relation to the horizontal.

Back Course Approach—A runway localizer approach in which the aircraft is flown in a direction opposite to that indicated by the localizer heading indicator (course arrow). Normally, a back course approach involves touching down at that runway end at which the localizer transmitter is situated.

Bank—Attitude, in degrees, about the longitudinal axis of an aircraft into which the aircraft is tipped or rolled. A bank is essential to all properly executed turns.

Bracketing—Making a series of trial approaches or crossing, and recrossing the radio marker beams to determine the correct approach heading.

Glide Slope—A portion of an instrument landing (ils) that provides navigational information about the aircraft's angle of glidepath to the runway letdown point.

Localizer—A vhf radio system for guiding aircraft along an approach path to an aircraft runway.

Omnirange—Short for omnidirectional radio range.

Radio Fix—In air navigation, the determination of the aircraft's position by use of navigational aids.

Figure 22. Typical approach diagram.
(Located in back of manual)

Figure 23. Vor navigation.
(Located in back of manual)

Figure 24. Ils approach.
(Located in back of manual)

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12–31 requirements for Operator's and Crew's Maintenance Instructions for AO–1 Aircraft.

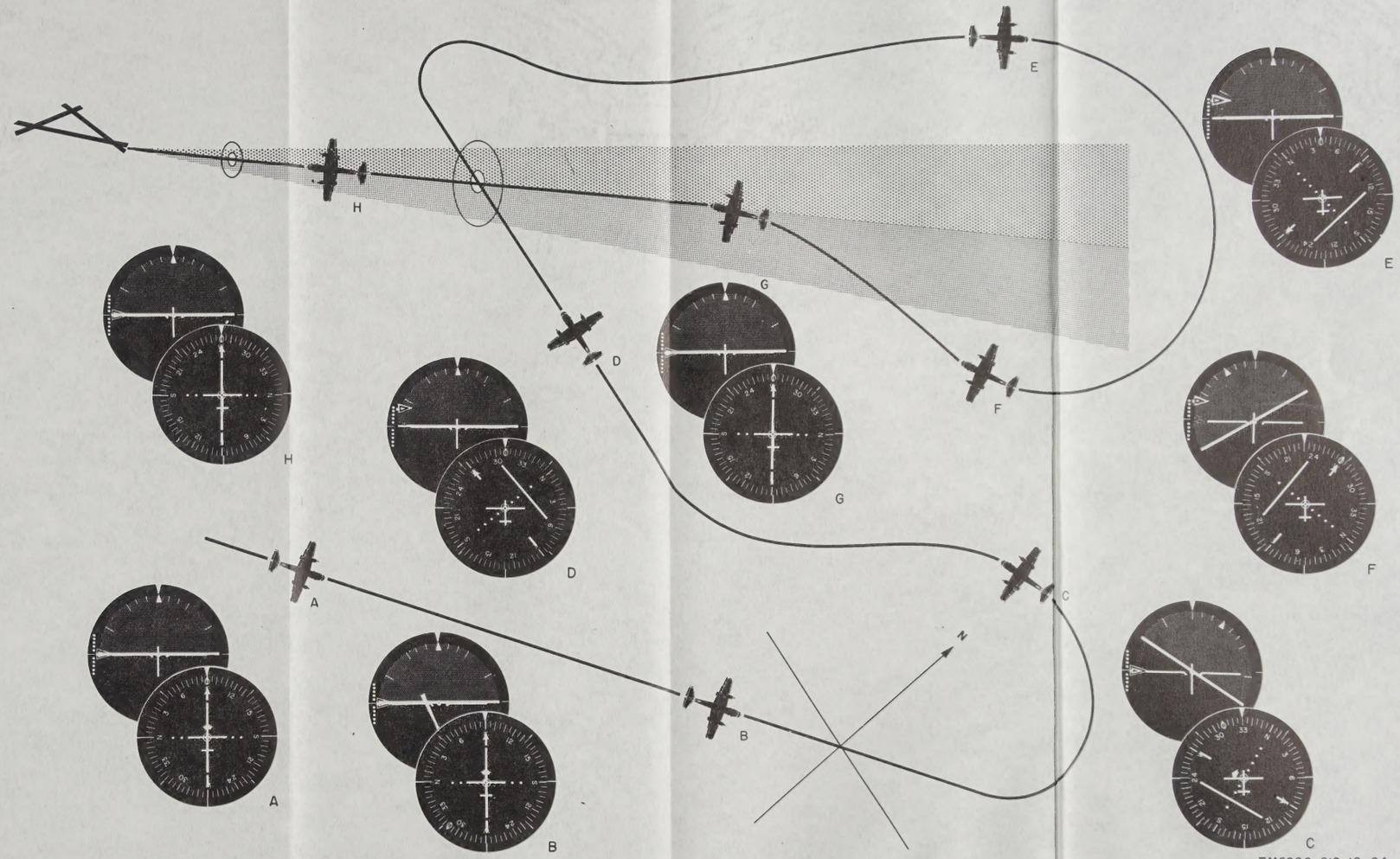
U.S. GOVERNMENT PRINTING OFFICE : 1962 O—630775

814–026–2

TM5826-218-12-24

Figure 22.

814-026-6



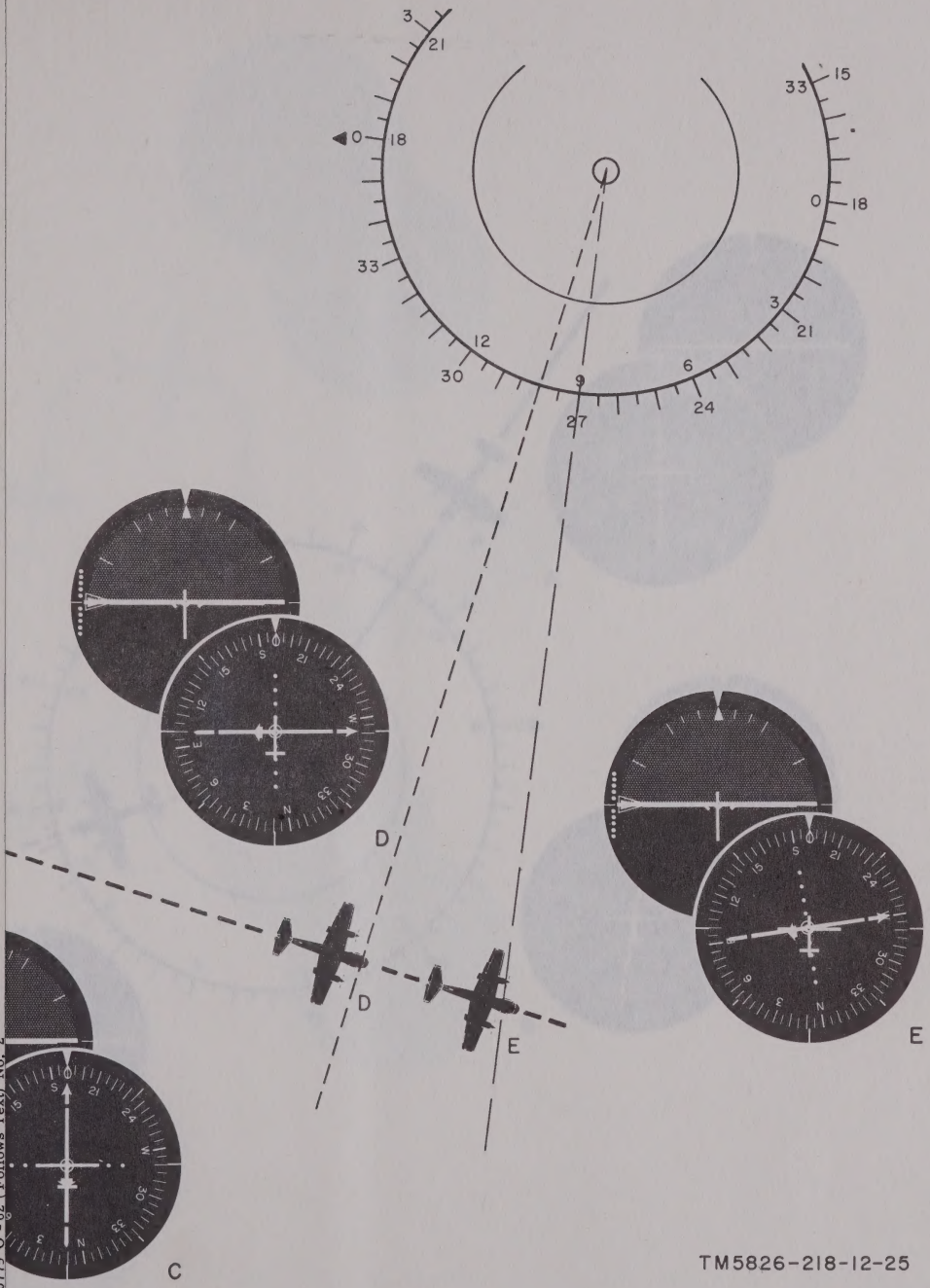
Typical approach diagram.

Figure 22.

630775 O - 62 (Follows Text) No. 1

814-026-6

FORM O-25 (REVISED 1-64) 50-1



TM5826-218-12-25

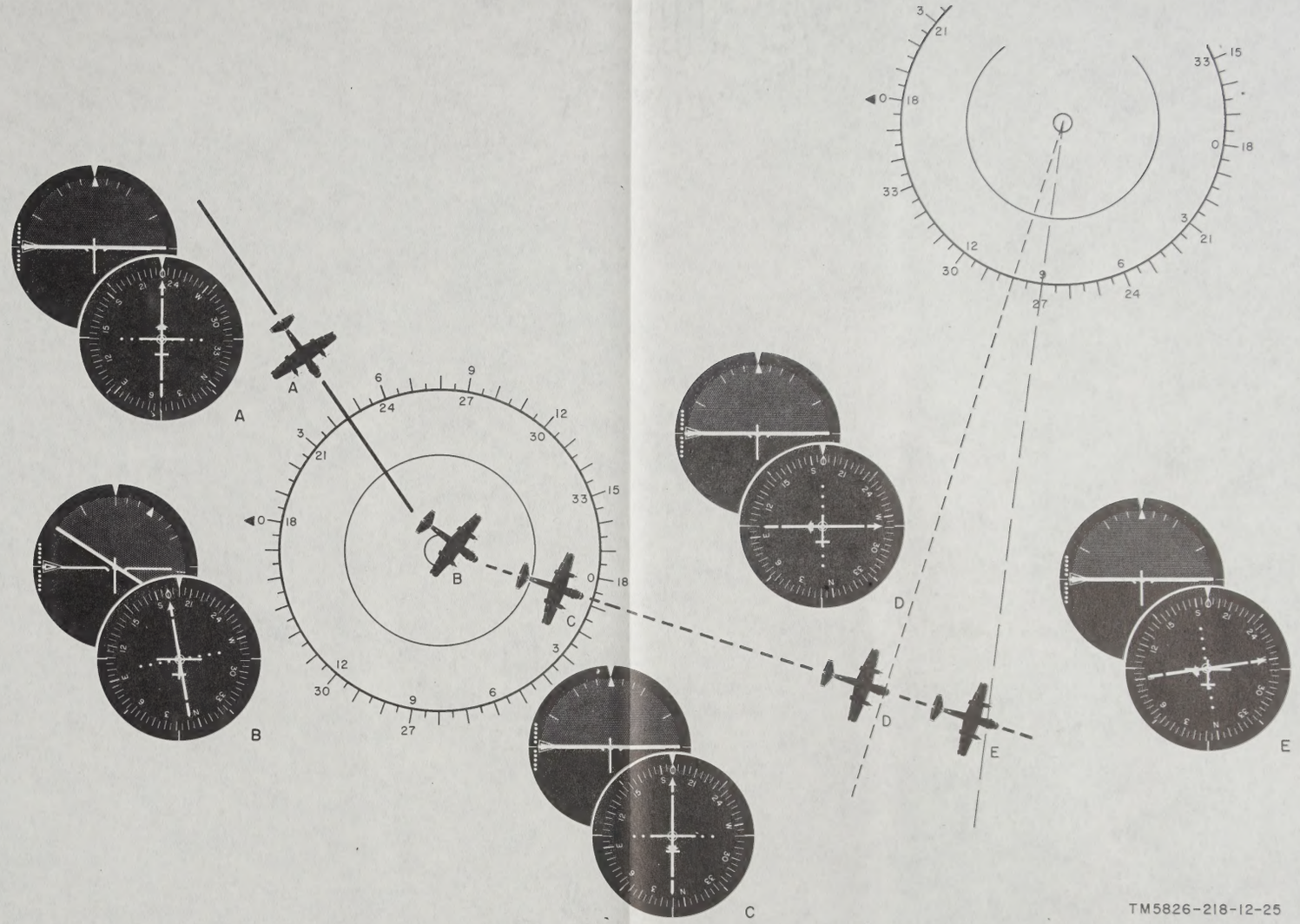
Figure 23.

avigation.

630775 O - 62 (Follows Text) No. 2

A

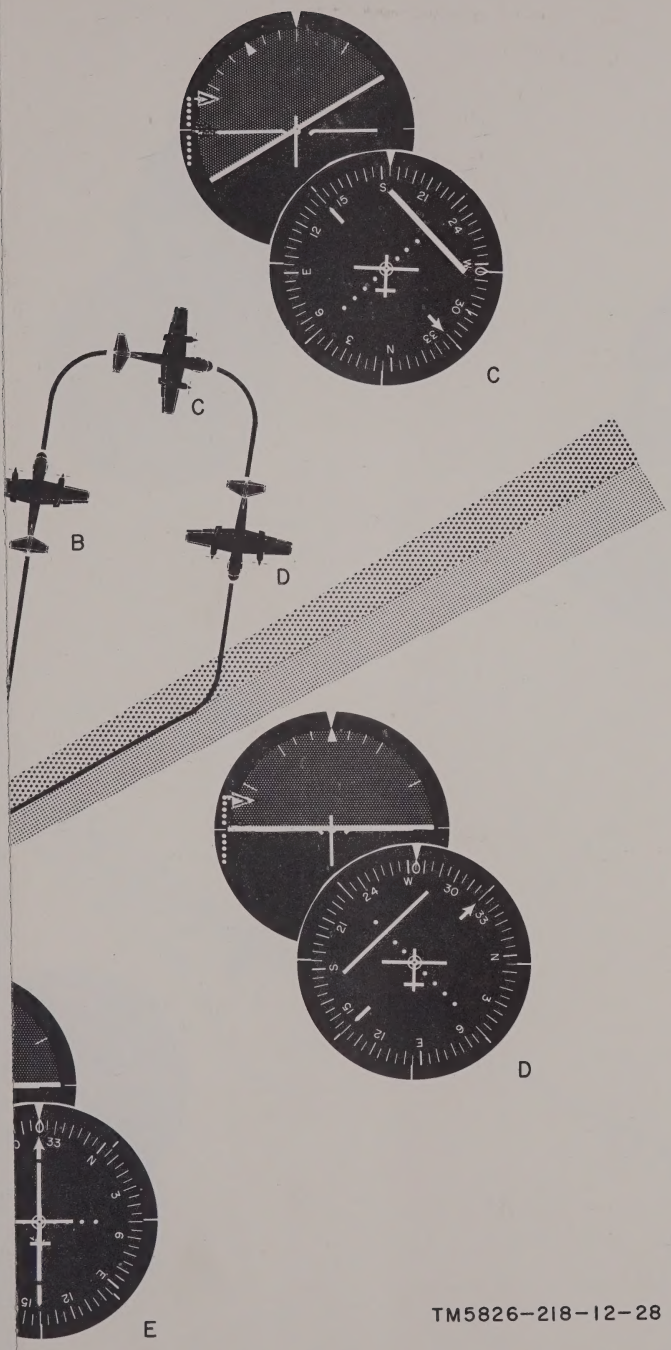
630775 O - 62 (Follows Text) No. 2



Vor navigation.

Figure 23.

A
B
C

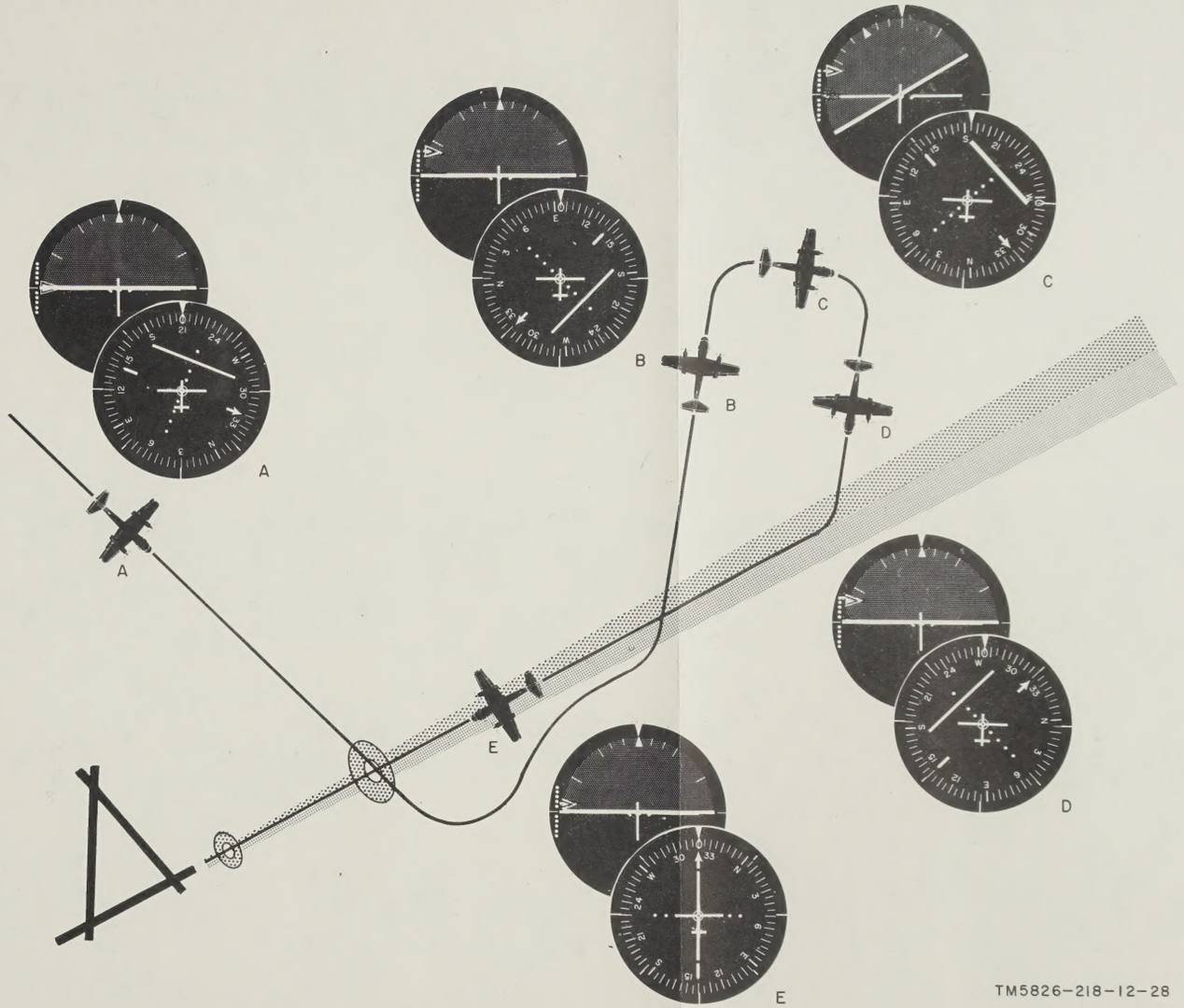


TM5826-218-12-28

Figure 24.

630775 O - 62 (Follows Text) No. 3

A
B
C



Ils approach.

Figure 24.

630775 O - 62 (Follows Text) No. 3

814-026-8

TM 11-5826-218-12—COMPUTER SET, NAVIGATIONAL AN/ASN-33 AND COUPLER, INDICATOR CU-865/ASN—1962